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AMERICAN ANTIQUITY

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APPLICATION OF THE WHEAT-GIFFORD-WASLEY TAXONOMY TO EASTERN CERAMICS

PHILIP PHILLIPS

IN A RECENT issue of this Journal a trio of Southwestern archaeologists proposed a new scheme of ceramic taxonomy that might, if widely followed, restore the possibility of intercommunication between specialists in North American archaeology (Wheat, Gifford, and Wasley 1958). I became interested in this scheme some time before its publication as a possible solution to certain typological difficulties in the Lower Mississippi Valley. One of the authors, James Gifford, encouraged my efforts to apply it to pottery so different from that for which it was devised, and, as an unforeseen result of numerous consultations with him, and with Stephen Williams, Gordon R. Willey, and Watson Smith, the present paper emerged. Its contents can hardly be described as an adequate test of the scheme or a thorough appraisal of its theoretical implications. The only excuse for putting it out in such a tentative form is that in our discussions certain amicable disagreements arose that may be the result of inherent differences between Southwestern and Eastern pottery. If so, it is perhaps vain to hope that a classification of this sort might be uniformly applied in both areas. On the other hand, if the differences, as I suspect, lie more in the domain of outlook and method, there is a possibility of compromise and accommodation that should not be left untried. My private feeling is that the modifications I am about to propose, to meet Eastern conditions, might be improvements in the Southwest as well, but that is not for me to say.

Assuming that the reader has before him a copy of the Wheat-Gifford-Wasley paper, it is unnecessary to describe their scheme in detail. Reduced to the briefest possible terms, they propose that types and varieties, defined to conflict as little as possible with existing usage, be organized into "type clusters," and these in turn into still larger "ceramic systems." The type cluster is to consist of an "established type," from which it takes its name, and any number of "varieties." The ceramic system will consist of a number of type clusters, the chief requirements being that they fall within the limits of a technologically defined class of pottery, and are "roughly contemporaneous," that is, within a time span on the order of a period in the Pecos Classification. By the same rule of priority the ceramic system takes its name from the first of its type clusters to have been formally defined and named. By means of this hierarchic organization of concepts, the specialist's need for more refined typology is met on the level of variety, convenient units for studies of regional scope are afforded on the level of type cluster, and the necessary generalizations for interregional and areal studies on the level of system. The authors reckon that all Southwestern pottery might ultimately be subsumed under 40 to 50 ceramic systems, a hopeful statistic for the students of tomorrow.

Description of what I like to think may be improvements upon this eminently reasonable scheme will be the subject of the first part of this paper. Before getting too deeply involved in these, however, it is necessary to refer briefly to a concept which is implicit in all ceramic typology, and ought perhaps to be formally recognized as the lowest member of any ascending taxonomic series. This minimal concept of differentiation is, of course, the familiar "mode," the indivisible attribute of manufacture, form, technique of decoration, or design (Rouse 1939). I find it difficult to consider the nature of types and varieties without bringing in the concept of mode. Ordinarily, types and varieties are defined by reference to a standard combination of modes, but they have sometimes been differentiated on the basis of single modes. It cannot be said that this is necessarily bad; single modes can be that important. But from the standpoint of economy it is surely preferable to keep such variations on the lowest possible taxonomic level, where they can be designated descriptively without having to be named. This

is by no means all that is to be said in favor of modes. Their importance in another connection will be considered in a later section of this paper.

Coming now to the concepts described in the Wheat-Gifford-Wasley paper, the modifications that I have to propose are largely, though not merely, verbal. The terms "established type" and "variety" are related in a manner that implies a ranking which, the authors freely admit, does not always exist. There is deliberate ambiguity in the juxtaposition of 2 statements about this relationship:

> A ceramic type cluster takes its name from the established type. The type, as distinguished from its varieties, is determined by the fact that it has the most comprehensive descriptive, geographical, or temporal range of the cluster. The entities related to it are varieties in a technico-stylistic, areal, or temporal sense (Wheat, Gifford, and Wasley 1958: 39).

This can only mean that it is the "established type" not only in the sense of priority of establishment, that is, of formal description and naming, but also in the sense of importance. Note the use of *its varieties*, denoting a dependent status on the part of these inferior units. But in the sentences immediately following that just quoted we find that this feudal relationship between type and variety does not always obtain:

> If, on the other hand, it can be shown that all the members of a type cluster are roughly equal in typological status, as may be the case with Alma Plain and its varieties (Forestdale Variety, Bluff Variety, Point of Pines Variety, and Black River Variety), then according to Colton's rules of naming and priority, the one first described in published form lends its name to the cluster; therefore the proper taxonomic title would be Alma Plain Cluster (Wheat, Gifford, and Wasley 1958: 39).

In this case, Alma Plain is the established type only in the sense of priority. It is not proper to speak of *its varieties* because they are neither included in, dependent upon, nor inferior to, Alma Plain. It would be more correct to call Alma Plain the "established variety" (as in fact I propose to do). The implied ranking is not in the word "established," but in the use of "type" and "variety" for what, in the example given, are precisely the same kind of entities ("roughly equal in typological status"). Furthermore, this may not be an exceptional case, even in the Southwest. The passage continues:

> It must be made clear that situations similar to that which pertains to the Alma Plain Cluster may be more frequent than has been implied (particularly with regard to relatively unstudied utility types), and indeed, in other areas may be the rule rather than the exception (Wheat, Gifford, and Wasley 1958: 39).

It is clear from the language used that the ambiguity in the type-variety relationship is intentional; in fact I know from conversations with Gifford that such is the case. The nomenclature is designed to cover 2 different kinds of relationships that probably exist in fact, at any rate are solidly built into existing Southwestern typology. Its avowed purpose is to build upon, rather than do violence to ceramic classification previously established by the Museum of Northern Arizona, Gila Pueblo, and others. To eliminate one or the other of the 2 kinds of implied affiliation would require some fairly drastic changes in long established type concepts and relationships. In the East there is not, I believe, the same need for ambiguity. Eastern pottery generally is more like the "relatively unstudied utility types" for which Wheat, Gifford, and Wasley predict that their second egalitarian kind of type-variety relationship will be more appropriate. For this, and other reasons that will appear as the argument proceeds, I am proposing to replace "established type" with "established variety," with no implications of taxonomic ranking over ordinary varieties beyond that of priority of formal description and naming. This releases "type" for further duty. I propose its substitution for "cluster." This is not just semantic indulgence on my part. In the East, the concept of variety has not received much attention. Most of our types are more like clusters whose varieties are often referred to but seldom defined as such. This change would not only be in the interest of economy, but would do the least damage to existing Eastern typology. Between treading on archaeological toes in the East and in the Southwest I am naturally in favor of the latter.

These changes in nomenclature would effectively remove any trace of ambiguity in the relationship of type and variety. (I am not objecting to ambiguity *per se*, but only when there is nothing to be gained by it.) At the risk of belaboring the obvious, I would point out again that, although nothing in the Wheat-Gifford-Wasley paper intends to convey the impression that the established type may include its varieties, there is in the ordinary meaning of "type" and "variety" such an implication. One thinks of a variety as being "of something," in this case

"of the established type." The authors carefully refrain from using the expression "varieties of the type," referring always to "the type and its varieties," but the word "its" again suggests the connotation "of the type." This entirely unintended implication is further reinforced by the deliberate ambiguity in the status relationship of type and variety quoted in the paragraph above. Wheat, Gifford, and Wasley are entirely clear about these matters, but in more pedantic minds there is a possibility of confusion. For a long time, and after many readings, I was still under the misapprehension that the first kind of relationship described was in fact one in which the established type included "its" varieties, in contrast to the second in which they clearly stood outside. In short, although I can see the compelling reasons for their choice of terms, I cannot agree that it was a happy one. In the more economical nomenclature proposed here, the type (as equivalent to their cluster) always includes its varieties; the use of "its" is altogether appropriate because varieties are always varieties of the type; there is no occasion to speak of the type *and* its varieties at all. For those who prefer definitions, the type is the sum total of the established variety and all other varieties. The established variety is distinguished only by its priority and the fact that it gives its name to the type.

The arguments covered in the preceding paragraphs are so crucial that it seems worth while to support them with an attempt to describe, by means of an example, what happens operationally. In 1939 James A. Ford and Gordon R. Willey described what I would now call a variety of the Lower Mississippi type Coles Creek Incised, characterizing it as a late "specialization which may be isolated as a type." Current Southeastern procedure indeed gave them no alternative and they set it up as the type Chase Incised (Ford and Willey 1939b: 6). Later, in his Greenhouse site report, Ford described this type again, this time referring to it explicitly as a late "variant" of Coles Creek Incised (Ford 1951: 76). In the same publication he described another late variety of Coles Creek under the name Greenhouse Incised (Ford 1951: 77-9). These two "types" have been thought of as varieties of Coles Creek ever since. Giving them formal type status has not made them independent. However, in theory and in practice, our concept of Coles Creek Incised has been cut back to exclude these varieties. Stratigraphic analysis has confirmed their slightly later position, and the result has been a contraction of the time span of Coles Creek as originally conceived. In short, the unit has suffered a significant diminution in content and temporal range by the loss of these 2 varieties. Working on collections from an adjoining region, I am on the point of launching 2 or 3 more varieties of Coles Creek. This will have the effect of further reducing its range, particularly in the geographical aspect. If this is an example of the normal development of ceramic typology, it must be granted that the nomenclature proposed here fits it admirably. Coles Creek Incised would remain a type of undiminished, or even increased, range and standing; what is left of the original content after all useful varieties have been set off — "classic" Coles Creek if you like — would be the established variety; named types that have failed to achieve independence like Chase and Greenhouse would be demoted to the status of variety; new varieties would be set up as required. Thus new entities and old would fall into their proper places in an expanding classification with a minimum of strain.

Another advantage of this nomenclature is of a more technical order. In the East, where the archaeologist commonly operates with sherds alone, the rule of sortability has been used as a criterion of type. That is, if sherds cannot be differentiated by the ordinary methods of hand sorting, they must be assigned to the same type. It is not my purpose to defend this rule, which sometimes leads to some very quaint results. Varieties, on the other hand, may or may not be sortable as sherds. They may, for example, involve a decorative scheme unrecognizable in small sherds, or a treatment that is confined to a small portion of the vessel. Such sherds can at least be classified as to type and thereby saved from extinction in the "unclassified" column. Their usefulness in actual practice will be referred to again.

You never get anything for nothing in this vale of sorrows. There is a disadvantage, of course, in that the type and its established variety will have the same name. However, if we follow the rule laid down by Wheat, Gifford, and Wasley, that the name of a variety must be accompanied by the name of the type (for example, "Coles Creek Incised, var. Coles Creek") there should not be too much confu-

sion. The type name standing alone would simply mean "Coles Creek Incised, var. unspecified."

The full extent of the differences between the Wheat-Gifford-Wasley nomenclature and mine may be seen by comparing Figure 1, top and bottom. In the second of these models, it will be noted, the lines connecting the established varieties in the center to the ordinary varieties outside are omitted to show that no relationship of dependence is implied. Any further nuances of difference can best be dealt with in connection with a trial demonstration of the scheme based on some of the well-known "Hopewellian" pottery types of the eastern United States.

The Hopewell Zoned Stamped System. In his great report on the archaeology of the Florida Gulf Coast, Willey suggested the formulation of a large-scale ceramic continuity based on the technique of zoned stamping. This is a kind of incised decoration in which contrasting zones are formed by roughening the background by means of plain or dentate stamping often applied with a rocking motion to produce a zigzag or "rouletted" effect.

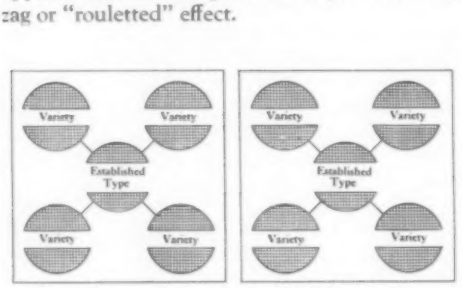


FIG. 1. Comparison of Wheat-Gifford-Wasley (top) nomenclature with that proposed in this paper (bottom).

Eventually a revision in the typology of eastern ceramics may unite zoned stamped pottery into a single major style or type with variant subdivisions such as Hopewell, Marksville, Alligator Bayou and others (Willey 1949: 372).

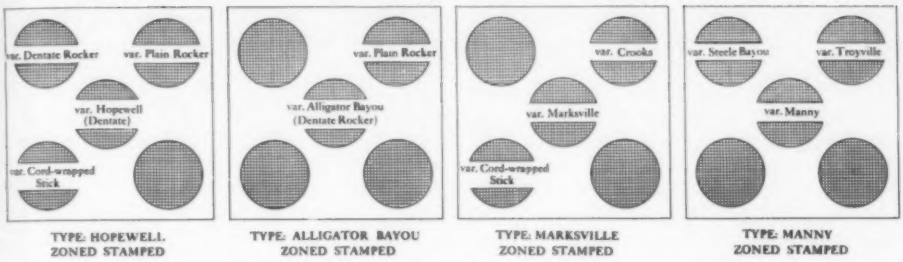
This pregnant suggestion was never followed up, as far as I know, probably because of the lack of a unifying concept to fit the case. The ceramic system seems to be exactly what is required (Fig. 2).

Calling it the Hopewell Zoned Stamped System is not strictly in conformity with the rules of priority. This name, I believe, was first put into print by James B. Griffin (1941, Pl. 14). The Louisiana type, Marksville Stamped, had been formally described a year earlier (Ford and Willey 1940: 65-74), but general recognition of the northern type as the outstanding mortuary pottery of the famous Hopewell culture goes back at least to the middle of the 19th century, an effective if not technical priority.

The breakdown shown in Figure 2 follows Griffin's more recent classification (Griffin 1952: 114-21), in which Hopewell Zoned Stamped is defined to include several techniques of background roughening. I have set these up as varieties, Griffin himself furnishing the precedent, for in the case of the closely related type Hopewell Rocker Stamped he gives us "Hopewell Rocker, var. plain" and "Hopewell Rocker, var. dentate" (Griffin 1952: 118).

This brings up the question of what sort of names varieties are to be given. Wheat, Gifford, and Wasley are silent on this point, but in their examples all varieties have site or local names in compliance with existing rules of naming in the Southwest. It seems to me, however, that technological varieties, as in the case before us, might ride along without names, until it is demonstrated that they are varieties in a temporal or geographical sense as well. This raises a further question. If such varieties fail to develop temporal or local significance, is there any point in maintaining their identities as varieties? It might be better to cut them back to the status of modes. Not as an answer to these questions, but simply to get on with my demonstration, I am refraining from putting site names to such provisional varieties except in cases where such names have already been given.

The next type in our system, Alligator Bayou Zoned Stamped, from the Florida Gulf Coast, has also been defined to include both plain



HOPEWELL ZONED STAMPED CERAMIC SYSTEM

FIG. 2. Trial formulation of a Hopewell Zoned Stamped Ceramic System.

and dentate stamping (Willey 1949: 372-4, Fig. 22 *a*, *b*, *d*, Pl. 17) here differentiated as unnamed varieties in accordance with what has just been said.

The third type shown in Figure 2, Marksville Zoned Stamped, has at least 2 varieties and a possible third. The established variety is that covered by the original type description already cited. Crooks Stamped, defined by Ford and Willey as a type, is based on a minor technological variation — the substitution of a small scallop shell for the usual rocker stamping tool. This is the kind of variation that might be treated on the level of mode, but there is considerable stratigraphic evidence of an early position in the Marksville phase, so it is fully entitled to the status of variety (Ford and Willey 1940: 82). The variety designated as "cord-wrapped stick" is a good example of a technological variation not presently deserving a name, though likely to have one in the future. It is based on a single vessel illustrated by Ford and Willey (1940: 72, Fig. 34) who mention no further examples. From other evidence there is a possibility that background roughening by this means may have a different history from that of the more common dentate rocker stamping, in which case this might become an important variety, or even a separate type.

The less said about the last type in my trial system, Manny Zoned Stamped, the less will have to be unsaid later on. This type has been formally differentiated from Marksville Zoned Stamped by Robert Greengo in an unpublished doctoral dissertation based on his excavations in the Lower Yazoo Basin north of Vicksburg, Mississippi (Greengo 1957: 117-37). Greengo called the type Jonesville Stamped. For reasons that need not detain us here, I have with his permission changed the name to Manny Zoned Stamped. It has been illustrated again and again under the heading of Marksville Stamped (Ford, Phillips, and Haag 1955: 80-3), but has long been tacitly accepted by Ford and other workers in the Lower Mississippi as a late variety of that type. My first thought was to set it up that way, but after sorting large quantities of sherds from Greengo's sites, I became convinced that it has important varieties of its own. One of these, Steele Bayou, I have put on the diagram to illustrate another question of procedure. This requires a brief divagation into another closely related ceramic system that I have tentatively set up under the name Hopewell Incised. One of the important Lower Mississippi types in this system is the well-known Yokena Incised. There is a rather distinct and probably late variety of Yokena, not heretofore classified as a separate entity. In his most recent description of Yokena Incised, Ford gives a paragraph to this variety, characterizing it as a "design arrangement of minor frequency," and illustrates a few sherds (1951: 52, Pl. 8, Q-S). This variety is closely related to a certain pottery type on the Florida Gulf Coast. For this reason alone it warrants a name and I have accordingly called it "Yokena Incised, var. Steele Bayou." The point of all this is that a number of sherds of Manny Zoned Stamped have turned up with the same decorative style as Steele Bayou. It seems worthwhile to set these up as a variety of Manny, but what to call it? In the Lower Mississippi we have been trying to avoid further duplication of type names, purely as a matter of convenience (if there were not a Marksville Incised and a Marksville Red Filmed, one could simply write "Marksville" instead of "Marksville Zoned Stamped"). The question is whether the same objections to duplication apply in the case of varieties.

Wheat, Gifford, and Wasley appear to think not. I am inclined to agree. It can even be argued that there is a positive advantage in such duplication as an expression of the very close relationships that frequently exist between varieties in different ceramic systems. This, again, depends on how well the rule that names of varieties must be accompanied by that of the type works in practice. Between "Manny Zoned Stamped, var. Steele Bayou" and "Yokena Zoned Stamped, var. Steele Bayou" there can be no confusion.

In the Lower Mississippi, zoned plain rocker stamped pottery (that is, in which the stamping is done with a plain unnotched instrument) has heretofore been classified as a single type called Troyville Stamped (Ford and Willey 1939a: 4-5). The interaction of this and dentate stamping (Marksville, Manny) is fairly clear. Without going into tiresome detail, it can be generalized chronologically as follows: (1) an early time when all stamping is dentate (Marksville); (2) both dentate (Manny) and plain (Troyville) are present as alternative treatments on pottery otherwise indistinguishable; (3) plain stamping (Troyville) has become dominant, and degenerative, and dentate has practically disappeared. The current description of Troyville relates more to the late degenerative aspect (Ford 1951: 49-50, Pl. 7 *a-l*), but most of the pottery that has been illustrated, including that from the Troyville site itself (Walker 1936, Pl. 12 *e-i*) seems to belong in the time (2) when both dentate and plain stamping were more or less interchangeable. This kind of Troyville at least can be appropriately classified as a variety of Manny Zoned Stamped, as I have done here. This is consistent with the varietal status given to plain stamping in the Hopewell and Alligator Bayou Zoned Stamped types. (The late degenerative variety of Troyville I have conveniently ignored.) If we had as much plain rocker stamped pottery in Illinois and Florida as we have in the Lower Mississippi, it might appear to be a more important variation, possibly too significant chronologically to be treated in such a subordinate fashion. In that case the plain stamped varieties of Hopewell and Alligator Bayou would have to be promoted, and Troyville restored, to type status. It is even conceivable that zoned plain rocker stamping might become the basis for a separate ceramic system. This at least should make it clear that the rules of this game have not been rigidly set. Flexibility is the operative word.

Evaluation. More types from other regions could be incorporated in a Hopewell Zoned Stamped system, but these are sufficient to show how it works. As a rather hasty trial, worked up for the occasion, it seems to have been fairly successful. The advantages of the scheme on the operating level have been sufficiently extolled by Wheat, Gifford, and Wasley. All that I can add by way of summary is that, with slight modifications in nomenclature, it can be adapted to the considerably different conditions of Eastern typology. It will perhaps bear repetition that it is not going to reduce the number of typological entities (except at the top) but it will organize them for use on different levels of specialization. If it does not do anything else, it will force the archaeologist to give thought to the nature of his ceramic formulations before throwing them out upon his helpless colleagues. What generally happens now, in the East at any rate, is that the archaeologist judges whether a variation is of sufficient importance to warrant a new type, or he ignores it entirely. This has the merit of simplicity and freedom from restraint, but the result of 20 years of such untrammeled activity is a condition bordering on anarchy. Types have been set up and certified by publication on the basis of all sorts of technological variations from the most minute to the most pervasive, with geographical and temporal dimensions to match. An extreme example, from the Lower Mississippi, is afforded by the comparison of the "types" Marksville Red Filmed, so far represented by 8 sherds and a single vessel (Ford and Willey 1940, Figs. 40, 42), and Larto Red Filmed (Ford and Willey 1939b: 7; Phillips, Ford, and Griffin 1951: 102-5; Ford 1951: 59-61) which includes all clay-tempered redware in the Lower Mississippi Valley for about 600 years. The first can now be classified as a mode of Marksville Incised (which it would be without the red paint); the second will surely turn out to be a ceramic system. A similar lawlessness has prevailed in the grouping of types into "series," a term which I have purposely shunned in this paper, because in the East no rule for the formation of such groupings has been consistently followed. The concepts of mode, variety, and type are not designed to curb, but only to place reasonable limitations upon, this pleasurable activity. In return for a

little discipline, the archaeologist is offered a wider range of choices. Furthermore, the flexibility that inheres in these concepts relieves him from any uncomfortable sense of finality. As an additional advantage, the proposed nomenclature, like insignia of rank, enables quick recognition of the importance of given variations by workers unfamiliar with the local or regional typology.

These favorable comments leave a great deal unsaid on a somewhat higher level of theory. Having constructed a ceramic system with all its parts neatly adjusted and working properly (as though they ever would), what good is it? What does it mean? Wheat, Gifford, and Wasley have neglected to emphasize sufficiently, in my opinion, that this is not a cultural system in any adequate sense of the term. Possibly they felt that this ought to be sufficiently obvious. I shall return to this point later. Right now I would prefer to keep the discussion on the working level a bit longer.

Assuming that the primary aim of ceramic taxonomy is to facilitate the daily operations of archaeology, such as stratigraphy and seriation, by means of which archaeological units (components, phases, cultures, and so forth) are isolated and compared, it must be evident that in these processes ceramic systems have to be torn apart and their constituent units reassembled in entirely different combinations. One such combination is what I understand by the term "ceramic complex," which may be defined as the sum total of modes and varieties (less often types) that comprises the full ceramic content of an archaeological unit, usually a component or phase. The full ceramic content of a culture involves such a wide range of pottery that it is not usually thought of as a complex, though I suppose it could be. Unlike the system, the complex may, and usually does, include different kinds of pottery, partaking of entirely distinct technological traditions. For example, the complex of a given phase of the Mississippi culture might include varieties of plain, modeled, incised, engraved, painted, negative painted, and fabric-impressed (salt-pan) types, each belonging to a different ceramic system. The intimate relationship of these technologically diverse variations would be revealed by their common possession of individual modes of manufacture, form, and design.

The complex, then, is the culturally meaningful grouping of these lowest level variations. If this is what we are after, why go through the tedious performance of constructing varieties, types, and systems? If modes are the cement that holds the complex together, why not concentrate on them, as Rouse and others have done, and leave all higher taxonomy to those who like to do that sort of thing? This is a very pertinent question. To examine it thoroughly would take another paper longer than this one, not to mention a lot of thinking which I have not done. We are all conditioned by the kind of archaeology we have had to do. I can only try to show why modes alone will not do the work, in the area that I know something about.

All archaeologists, I suppose, operate initially by means of what for want of a better name is often described as "feel," which is simply the unformulated recognition of relationships on the modal level. The next step (which is not always taken) is to objectify the "feel" so that it can be accepted with confidence and systematically incorporated into the body of archaeological knowledge. In the Lower Mississippi, where we have to operate almost entirely with sherds, this has usually been effected by some sort of primitive statistical or graphic analysis. Let us suppose that we are trying to validate the "feel" that components A, B, and C might be combined to form the nucleus of an archaeological phase X. The most useful categories of modes in this kind of analysis are those of vessel shape and design (modes of manufacture and technique of decoration being usually not sufficiently specific). Unfortunately, modes of vessel shape and design seldom reveal themselves on ordinary average-sized sherds, so the frequencies are likely to be too small for statistical treatment. However, if the modes do not show, the varieties usually do, and here the frequencies may be adequate. Sherds that cannot be sorted as to variety can at least be typed, on which level the frequencies are still better. Assuming that, by a combined analysis of modes, varieties, and types, we have determined that the original hunch was sound, that our phase X is at least a reasonable hypothesis, we may then proceed to describe the pottery complex of said phase in terms of modes alone —a better way perhaps than by a tiresome column of percentages. However, when the time comes to add more components, or to compare phase X with other phases, we have to go back to the combined mode-variety-type analysis again. The reason, of course, is that

long lists of attributes without adequate quantification do not lend themselves to ready comparison. The difficulty is the same as that involved in trait list comparison, a familiar problem in Eastern archaeology. So far as I know it has not been solved. It is conceivable, of course, that in some instances there may be enough pottery to permit comparisons by means of highly selected diagnostic modes in sufficient frequencies for statistical treatment, and eventually this happy condition may become general. Then types and varieties might be allowed to wither away and no one will regret their passing. In the meantime they seem to be indispensable.

This, I think, disposes of the question, "Why do it?" It will not have escaped the reader's attention, however, that the justification, if such it can be called, is centered on the concepts of mode, variety, and type. It may still be asked whether the concept of ceramic system is equally indispensable. If it is only a question of mnemonics, why not group types together by means of some concept already in existence? "Ware" is already committed in an entirely different sense. "Style" is altogether too broad. The only other possibilities that come to mind are "horizon" and "tradition." By placing rather definite temporal limits on their ceramic system, Wheat, Gifford, and Wasley have given it a markedly "horizontal" look, but they have also indicated that "horizon" is too inclusive. A pottery horizon would in fact include several ceramic systems. In the East there is the added objection that our systems, if Hopewell Zoned Stamped is a fair example, cannot be contained within periods of time of the order specified by these authors. If the radiocarbon dates now available, and estimates where these are lacking, are approximately correct, the Hopewell Zoned Stamped system was in existence for at least 500 years. This is plainly not a horizontal phenomenon. It looks in fact a good deal more like a tradition. I must admit that this concept, as redefined by Willey and myself in a recent publication (Willey and Phillips 1958: 37), comes very near to fitting the particular case. The "Hopewell Zoned Stamped tradition" sounds quite sensible. But would it fit other cases? In the East possibly; in the Southwest apparently not. If "tradition" were to be used in the context of the Wheat-Gifford-Wasley scheme, it would be in connection with the ceramic sequence, not the ceramic system.

There is, however, a better reason for shunning terms like "horizon" and "tradition." Even when technologically oriented, these concepts are loaded with implications of area, time, and genetic relationship. Going up the taxonomic scale from mode to type is an easy grade, but from type to horizon or tradition we have to shift gears from the mainly technological to the mainly cultural and historical. This, I think, disposes of the second question, "Is a new concept like ceramic system necessary?" I would go further than Wheat, Gifford, and Wasley, however, and make a virtue of the necessity by freeing the concept of all but the most general implications of area, time, and culture. The entire scheme would thus become a strictly formal taxonomy right up to the top. If we do this, there will be no excuse for making the mistake of expecting it to yield automatic solutions to cultural and chronological problems.

In the concluding paragraph of their paper, Wheat, Gifford, and Wasley express the wish that others might come forward with suggestions for improvement, a request with which I have perhaps too generously complied. It remains only for me to extend the same invitation. In my view, all the concepts discussed in this paper, from mode to ceramic system, are but tools. A little abrasion will be good for them.

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HARVARD UNIVERSITY
Cambridge, Mass.
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SIMILARITIES IN HOHOKAM AND CHALCHIHUITES ARTIFACTS*

ANN STOFER JOHNSON

ONE OF THE most stimulating problems in present day Southwestern archaeology is that of relationships to the south — to the high cultures of Mexico. Evidence of such relationships is strongest in the Hohokam remains of southern Arizona. The broad outlines of Hohokam development have been fairly well established. The same is true for the cultures of central Mexico. The next step in solving the problem of Mexican-Southwest relationships would appear to be that of obtaining an understanding of culture history in the area between central Mexico and southern Arizona.

The most recent work in this direction has been that of Lister (1955; Lister and Howard 1955) and Kelley (1956). One of Kelley's projects in northern Mexico has been the excavation of the Schroeder site, which is located near the city of Durango, Mexico. Sites in the vicinity of Durango have been identified as belonging to the Chalchihuites culture by Lister (1955: 57). Kelley has assigned the Schroeder site to the Chalchihuites archaeological zone of the La Quemada-Chalchihuites culture (1956: 129-30), suggesting the existence of a regional breakdown of the cultures within a larger area. This Chalchihuites or La Quemada-Chalchihuites culture extends through the states of Zacatecas and Durango (Fig. 1), and has strong relationships with the high cultures of central Mexico (Kelley 1956: 128, 131-2). See Kelley (1956) and Lister and Howard (1955) for general descriptions of this culture.

The Chalchihuites culture in the vicinity of Durango has been dated by trade objects and radiocarbon assays from the Schroeder site, where a range from about A.D. 650 to about 1350 has been determined (Kelley, personal communication). At the time that the present study was made, early and late phases of the Durango variant of the Chalchihuites culture had been isolated. This 2-fold division will be used here, although more recent analysis of the Schroeder site material has resulted in a 3-phase sequence (Kelley, personal communication).

The Hohokam chronology is derived from treering dated sherds from the site of Snaketown. The entire sequence runs from 300 B.C. to A.D. 1400 (Gladwin and others 1937: 247-60). Various revisions of this original Hohokam sequence have been proposed. However, these revisions do not affect that part of the sequence which is dealt with in this paper. The Chalchihuites culture, as it is now dated, was contemporaneous only with the latter part of the Gila Butte phase and the Santa Cruz phase of the Colonial period, the Sacaton phase of the Sedentary period, and the Soho and Civano phases of the Classic period.

A more general survey of the relationships between the Hohokam and Chalchihuites cultures than is provided by this paper is found in Jennings and others (1956: 91-8).

FIG. 1. Map showing areas of the Hohokam and Chalchihuites cultures. Hohokam is indicated by horizontal hatching; Chalchihuites by vertical hatching. Culture distributions from Lister and Howard (1955, Fig. 38) and Jennings and others (1956, Fig. 1 *a*).

* This paper was originally read at the 33rd annual meeting of the Southwestern and Rocky Mountain Division of the American Association for the Advancement of Science, Tucson, April 29, 1957. I would like to express my appreciation for the help and encouragement of J. Charles Kelley, Emil W. Haury, and R. H. Thompson.

During the summer of 1956 I was a member of Kelley's field party at the Schroeder site. In connection with this work I had the good fortune to study the private collection of Sr. Federico Schroeder, who located the site which bears his name.

The portion of Schroeder's collection which was found in the vicinity of Durango is believed to be fairly representative of the Chalchihuites culture of that region. Objects studied include 29 whole vessels, about 100 stone and shell beads, pendants, and figurines, and 1 copper bell. This collection should provide a sufficiently sound sample for an introductory investigation of similarities in small artifacts of the Chalchihuites and Hohokam cultures.

The following 32 shared traits have been isolated. Most of these traits are ceramic elements. This is both a reflection of the emphasis on pottery in the Schroeder collection, and of the value of pottery as an expression of the individual character of a culture.

POTTERY

Color. Red-on-buff or cream.

Form

- Shallow, incurved bowl (Fig. 2 *a*).
- Elliptical jar, with small mouth (Fig. 2 *b*).
- Pedestal base (Fig. 2 *c*).
- Tripod vessel (Fig. 2 *d*).
- Low, angled shoulder (Fig. 2 *e*).
- Basket handle (Fig. 2 *f*).
- Effigy handle (Fig. 2 *g*).
- Bird-effigy vessel (Fig. 2 *h*).

Design layout

- Quartered (Fig. 2 *i*). In both ceramic complexes life forms and geometric designs are found within the quarters.
- Perpendicular panels of banded patterns (Fig. 2 *j*).

Linework

- "Squiggly" lines (Fig. 2 *k*).
- Ticking at rim (Fig. 2 *l*).
- Fringe at rim (Fig. 2 *m*).

Elements of design

- Interlocking scroll (Fig. 2 *n*). Hohokam scrolls are usually a negative design; the opposite is true of Chalchihuites scrolls.
- Non-interlocking scroll, with straight line base (Fig. 2 *o*).
- Rectilinear scroll (Fig. 2 *p*). In Hohokam design this element usually occurs in repeated bands; in Chalchihuites design it occurs as an isolated element.
- Herringbone (Fig. 2 *q*). In Hohokam pottery this design element is usually incorporated into the over-all design; in Chalchihuites work it is an isolated element.
- Small elements (Fig. 2 *r*).
- Variations of the bull's-eye (Fig. 2 *s*).
- Rows of dots (Fig. 2 *t*). In Chalchihuites design the use of rows of dots to outline life forms is the general rule; in Hohokam pottery it is rare.

Life forms

- Coiled snake (Fig. 2 *t*).
- Outstretched snake (Fig. 2 *u*).
- Bird (Fig. 2 *v*). Note the curlicue tail in each example.
- Bird-snake combination (Fig. 2 *w*). This combination occurs quite often in both ceramic complexes. It may be interpreted as a bird eating a snake.
- Toothed animal (Fig. 2 *x*). The Hohokam figure is a shell pendant.
- Humped-back quadruped (Fig. 2 *y*). Figure 2 *y* bottom right is a shell pendant.

PENDANTS OF STONE AND SHELL

Bird form (Fig. 2 *z*).

Geometrical

- Rectangular (Fig. 2 *aa*).
- Figure-8 (Fig. 2 *aa*).

PALETTE (Fig. 2 *bb*).

COPPER BELL

The only definite conclusions which are permitted by the nature of the material used in this comparison are statements of types of artifact similarities which appear in the material remains of the 2 cultures. However, some sort of historical relationship between the 2 cultures is suggested by these similarities. Comparison of traits common to artifacts of both Schroeder's collection and the Hohokam culture, when made with reference to the time in which these elements occur, has resulted in some *hints* as to these historical connections.

The extent of this contact is indicated both by the number of shared elements, and by the complexity of some of them. Examples of these unique elements are the bird-snake combination, the basket handle, and the toothed animal. That any one of these elements, much less all 3, would be independently conceived is difficult to believe. The hypothesis that they were diffused is supported by the number of less complex elements which occur in both cultures: bull's-eye, scroll, quartered layout, rectangular pendants. Although these traits occur frequently in prehistoric remains elsewhere in the world, the fact that they enter the Hohokam sequence with more complex traits suggests that they, too, are of importance in studying the relationships of the Hohokam and Chalchihuites cultures.

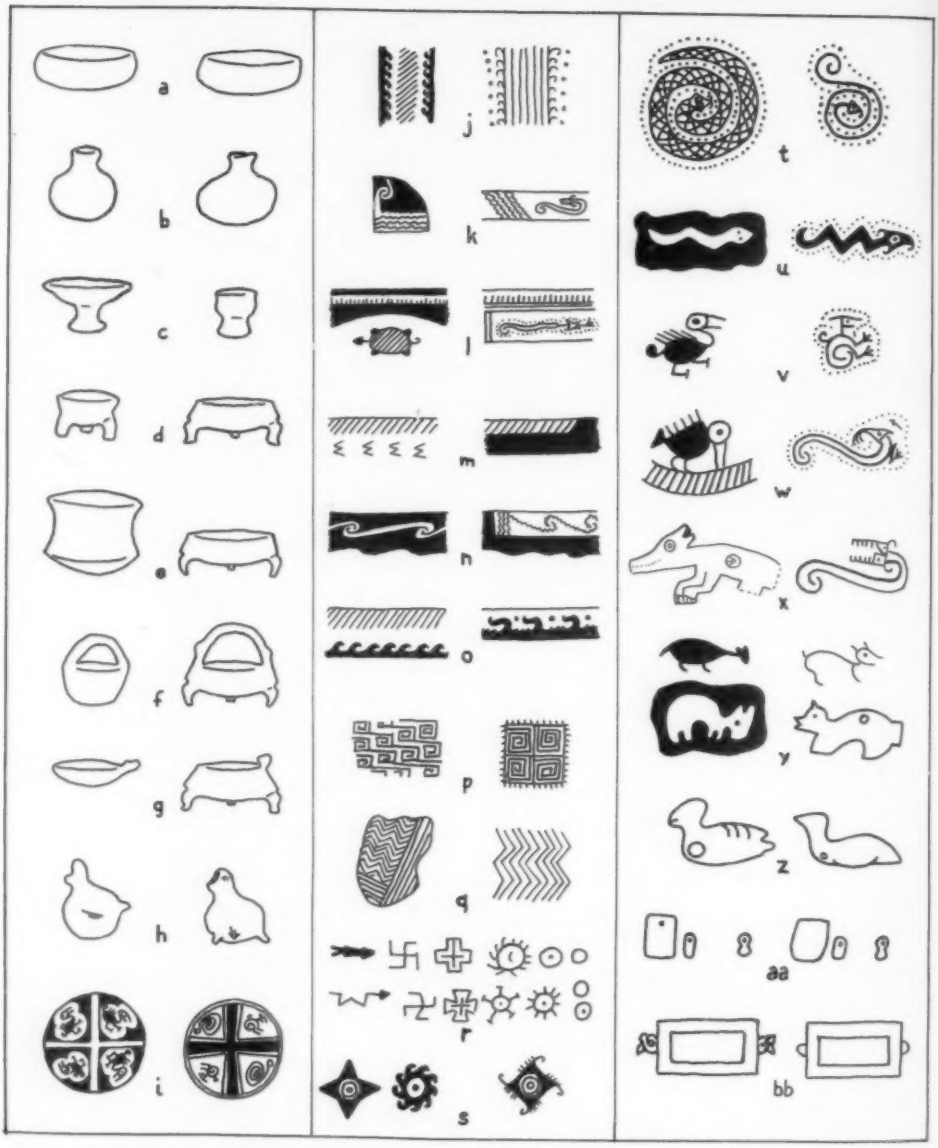

FIG. 2. Traits common to Hohokam and Chalchihuites material culture. Hohokam items are on the left; Chalchihuites on the right. *a*, shallow, incurved bowl; *b*, elliptical jar, with small mouth; *c*, pedestal base; *d*, tripod base; *e*, low, angled shoulder; *f*, basket handle; *g*, effigy handle; *h*, bird effigy; *i*, quartered design layout; *j*, perpendicular panels of banded patterns; *k*, "squiggly" lines; *l*, ticking at rim; *m*, fringe at rim; *n*, interlocking scroll; *o*, non-interlocking scroll; *p*, rectilinear scroll; *q*, herringbone; *r*, small elements (Hohokam, top; Chalchihuites, bottom); *s*, variations of bull's-eye; *t*, rows of dots, and coiled snake (Hohokam example reconstructed from sherd); *u*, outstretched snake; *v*, bird; *w*, bird-snake combination; *x*, toothed animal; *y*, humped-back quadruped; *z*, bird pendant, stone; *aa*, rectangular and figure-8 pendants, shell; *bb*, stone palettes. Not to scale.

References for Fig. 2. All Chalchihuites items are from the Schroeder collection. All Hohokam items are from Gladwin and others (1937), except *x* which is from Haury (1945a). *a*, Fig. 65 *a*; *b*, Fig. 67 *i*; *c*, Fig. 78 *i*; *d*, Fig. 68 *c*; *e*, Fig. 64 *f*; *f*, Fig. 65 *i*; *g*, Fig. 78 *g*; *h*, Pl. CXXXIV *b*; *i*, Pl. CLVIII *j*; *j*, Pl. CXLII *b*; *k*, Pl. CLVIII *c*; *l*, Pl. CLXXX *v*; *m*, Pl. CXLVII *d*; *n*, Pl. CLXXIII *b*; *o*, Pl. CLXIV *b*; *p*, Pl. CXLI *b*; *q*, Pl. CLXII *d*; *r*, Figs. 70, 77; *s*, Pls. CXXXIV *e*, CXLVI *a*; *t*, Pl. CLXXIX *h*; *u*, Pl. CLXXX *d*; *v*, Pl. CLVII *j*; *w*, Pl. CLXVI *w*; *x*, Haury 1945a, Fig. 94 *i*; *y*, Pls. CLXIX *n*, CLXXX *i*; *z*, Pl. CVIII *f*; *aa*, Pls. CXV *b*, CXVI *a*, and Fig. 54 *d*, *e*; *bb*, Pl. CI *e*.

It has long been recognized that Gila Butte pottery designs mark the beginning of a departure from the previous Hohokam design tradition (Gladwin and others 1937: 188). In this study most of the traits common to Hohokam and Chalchihuites ceramics occur first in the Gila Butte phase and continue through the Santa Cruz and Sacaton phases. This suggests that elements were introduced in the Gila Butte phase from the south, and that they persisted into later phases.

There appears to be a clustering of shared traits in the early part of the Chalchihuites sequence. About ⅔ of the common elements can be placed in the early part of the Chalchihuites sequence, equivalent in time to the Gila Butte and Santa Cruz phases. Only ⅓ occurs in the late part of the Chalchihuites sequence, equivalent in time to the Sacaton phase. By contrast, in the Hohokam sequence the shared elements are fairly evenly distributed throughout the Gila Butte, Santa Cruz, and Sacaton phases. This apparent clustering of shared elements may indicate more Chalchihuites-Hohokam contact early in the Chalchihuites sequence, with a later change in elements of Chalchihuites material culture, and a continuance among the Hohokam of the early introduced elements.

There is some evidence that different categories of elements common to the ceramic traditions of both cultures may have chronological significance. Shared elements of painted pottery design are generally early in both areas; similar vessel forms late. This sequence might be expected, since it requires less effort to change the motor habits involved in painting a vessel than those involved in shaping a vessel. This fact may also provide a clue as to the type of relationships between the 2 cultures. Changes in pottery design were gradual, and, as is discussed below, were adaptations rather than direct copies. This, with the fact that no trade sherds have been found in sites of either culture, would support a view that contact between the 2 areas was not close, although a tenuous and perhaps indirect contact and interest may have existed for several centuries. In contrast, Salado and Casas Grandes pottery from southern Arizona and Chihuahua indicates a more intimate north-south relationship. The Tonto Polychrome of the Salado has copies of Casas Grandes type human effigy vessels, while Animas Polychrome of Casas Grandes is a copy of Tonto Polychrome (Haury, personal communication).

Some common elements occurred earlier than the Gila Butte phase in the Hohokam sequence, however. These were: stone palettes, non-interlocking scrolls, quartered design layout, shallow incurved bowls, and the use of dots. These elements which occur early in the Hohokam sequence may indicate either (1) fortuitous occurrence, (2) an unknown source of influence for both cultures, or (3) a foreshadowing in the Hohokam of a later, stronger influence from the Chalchihuites culture. It must be remembered, however, that these suggestions depend on the validity of the Schroeder collection as representative of the range actually present in the Chalchihuites culture as a whole.

It might be well to mention here some of the more obvious differences in the pottery of these 2 cultures. Chalchihuites vessels are relatively small, with harder paste, and finer modeling. They are slipped and polished, and are decorated in 2 colors of paint with greatly stylized life forms. This is in contrast to Hohokam pottery, which is distinguished by larger vessel size (especially in the Sedentary period), which has a fairly soft paste, is skillfully but not delicately modeled, is unslipped and unpolished, and which is decorated in paint of only one color with cursively executed but realistic life forms.

The more elaborate designs of Chalchihuites pottery, such as the use of dots to surround life forms, or the specializations of the bull's-eye, suggests that some elements had become "watered down" upon reaching the Hohokam. At the same time the small elements, such as the circle and cross, appear to have been seized upon for local elaboration among the Hohokam.

Hohokam use of dots is interesting in this respect. A row of dots outlining life forms is a very prominent characteristic of Chalchihuites pottery design. In Hohokam design, however, rows of dots are seldom used in this manner. Instead they are placed in conjunction with geometric elements, or, if they are associated with life forms, occur as a filler within the outline of the animal. Hohokam life forms always utilize some type of line work (hatching, crosshatch, or solid color) as a filler, and the use of dots as such is consistent with Hohokam design tradition. There is only one example of dots *outlining* a Hohokam life form that I have found (Gladwin and others 1937, Pl. CLXXIX

h). This is a coiled snake whose body is cross-hatched. The result of the addition of the outlining dots is to make the design cluttered and confusing (Fig. 2 *t*). From this evidence it might be inferred that the use of rows of dots was an idea which somehow was introduced to Hohokam potters, and which they experimented with in several types of design. However, for esthetic reasons, they soon rejected this design element as an outline for life forms, but retained it in other design contexts.

The differences between Hohokam and Chalchihuites pottery and small artifacts which have just been discussed are immediately apparent to the observer, and point up the necessity of keeping in mind the strong continuity which has been demonstrated to exist between the various phases of the Hohokam sequence (Gladwin and others 1937). The similarities in Hohokam and Chalchihuites artifacts by no means indicate a migration of people to southern Arizona from the south, or even actual contact between the 2 areas. Relatively close as the city of Durango is to southern Arizona, there are nonetheless about 1000 miles between the 2 areas. Further exploration and excavation in the intervening area of northern Durango, Sonora, and Chihuahua are necessary before the nature of Hohokam-Chalchihuites relationships can be stated with assurance.

It should perhaps be pointed out that the idea of influence from south to north is a tradition in Southwestern archaeological interpretation, based on the knowledge that such items as mirror backs and ball courts have a greater antiquity in Mesoamerica than in the Southwest. If these items entered the Southwest from Mexico, it is not illogical to assume that other elements came from the same direction. This south-to-north diffusion does not rule out the possibility of influence in the other direction, however. In fact Haury (1945b: 65) and Lister and Howard (1955: 128) have suggested that the ¾-grooved ax and extensive use of shell for ornaments may have spread from north to south.

It is difficult to appraise in any but tentative fashion the historical significance of the similarities in Hohokam and Chalchihuites artifacts outlined in this study. The present status of the archaeology of both Hohokam and Chalchihuites cultures, as well as the lack of information from the intervening area, contribute to this difficulty. Nevertheless, this comparison of small artifacts of the 2 cultures does substantiate the long held idea that the Hohokam were strongly influenced by peoples to the south. We can also conclude that the Chalchihuites culture presents a source for southern influence which is much closer spatially and temporally to the Hohokam area than previously suggested sources further south in Mesoamerica.

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UNIVERSITY OF ARIZONA
Tucson, Ariz.
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ECOLOGICAL INTERPRETATION IN ARCHAEOLOGY: PART II

C. W. Meighan, D. M. Pendergast, B. K. Swartz, Jr., and M. D. Wissler

IN A previous paper (Meighan and others 1958), we considered techniques whereby the archaeologist can derive conclusions concerning prehistoric man's relationship to his environment. We limited our study to hunting and gathering societies since we felt that these were most directly and intimately affected by environment. In the present discussion, we have attempted to expand our study to include archaeological communities marked by the presence of agriculture, domestic animals, or both. Our inquiry can be phrased thus: what physical remains associated with agricultural communities can be used as evidence for ecological inferences? The answers to this question are neither as numerous nor as obvious as we first supposed, yet such answers are basic to an understanding of culture history. It appears that ecological inferences are in general made on the basis of poorly understood assumptions — and often assumptions for which there is little if any physical evidence in the archaeological site. Exploration and clarification of these assumptions is therefore of some importance in developing a systematic body of knowledge.

It should be apparent that the principle difference between the communities of hunters and gatherers and those of farmers lies in the environmental relationship. The hunter or gatherer relies upon the provision of nature; the farmer is actively changing his environment in order to make it better suit his needs. Yet the farmer must work with an environment that has limiting qualities of climate, soil, water supply, and similar features. At the same time the farmer's ability to alter his environment is limited by his technology, social organization, and other cultural factors. The relationship between these various conditions should be inferable from the physical remains that form the basis for archaeological study.

In surveying the literature, we have found that most inferences concerning ecology of prehistoric agricultural communities have been derived from ethnographic accounts of folk communities. For example, the picture of ancient Maya agriculture is very heavily based on the assumption that the prehistoric Maya farmed in the same way as the living Maya. Such assumption is probably valid, but it is important to realize that the physical archaeological evidence for it is scant indeed. We do not question the importance of ethnographically-derived inferences, but for purposes of the present paper we are not concerned with such inferences. Rather, we are seeking direct archaeological evidence from which an ecological conclusion may be drawn. Once these archaeological evidences are isolated and defined, it may be possible to reach more precise and detailed conclusions in site reports, particularly in those regions where ethnographic knowledge is too limited to provide support.

Archaeologists too often leave their ecology in the ground, due to interest in artifacts and ignorance of techniques for observing and interpreting ecological evidence. The utility of this paper lies in its presentation of a number of site features to be considered in seeking ecological information.

Environmental Features Associated with Agriculture

Although the farmer, in contrast to the hunter and gatherer, modifies his environment, he must contend with both geographical and cultural limiting factors.

Agricultural communities must be located in areas amenable to plant cultivation. This limits the choice of settlement to regions of sufficient water supply and arable land. The limitation of technology is perhaps best demonstrated by the fact that grassland areas never were utilized by farmers until the invention of adequate tools which could break up the tough sod. The grassy plains of North America were never cultivated by the Indians (Sauer 1956). And likewise, in British Honduras, Mayan sites are not found within the Pine Ridge areas which are grasslands with sandy soil, unsuited to milpa cultivation (Thompson 1939). Consequently, the prehistoric farmers were restricted to areas where the soil could easily be worked, as in river valleys, deltas, or deforested regions.

In an incipient or less developed type of agriculture, communities seem to depend more on close proximity to water supply and arable land. In the Southwest, the Cohonino sites are restricted to the streams where both water and soil were available (Mc.Gregor 1951), and the Mogollon settled on high mesas in mountain valleys overlooking their farmland (Wheat

1955). The Chaco Anasazi practiced floodwater farming, living in scattered villages near small arable plots (Haury 1956). In the Mississippi and Illinois river valleys the villages were located on high ground but near the rich river soils (Williams 1956; Mc.Gregor 1957). This is also true for the Central Plains where the farming took place in the creek bottoms (Wedel 1953).

In a more developed agricultural economy, the farmers, though still dependent on both water and soil, can control the water supply by irrigation methods and as a result can live farther from the actual water source. The Hohokam of the Southwest lived as much as 7 miles from the river in the broad valley and brought the water to their fields with an extensive network of canals (Haury 1956). The farmers of the Peruvian coast also used this method of cultivation (Willey 1953), as did the people of Mesopotamia and Egypt (Frankfort 1951).

Here also, soil was artificially built up either by terracing, as practiced by the ancient Andean farmers (Bennett 1946), or as with the Aztecs, through the use of chinampas (Vaillant 1944), and similarly, the diked-in islands of the marshy lands that provided farming soil for the people of southern Mesopotamia (Frankfort 1951). It is possible for the archaeologist to find physical evidence for such features as those just discussed, that is, canals, terraces, field plots, and the like (Table 5).

In some instances (Narr 1956), it has been possible to plot prehistoric Danubian Neolithic sites in Europe and show a close correlation with a certain kind of soil. These farmers preferred the well drained fertile loess soils which were easier to work. In some regions they seem to have selected a particular kind of loess in which the soil shows a higher degree of basal saturation. On the other hand, in Northern Rhineland the corded ware-bell beaker peoples preferred the poorer and sandier soils less favorable for agriculture than the loess of Central Europe. On the Anatolian plateau, agriculture is found in the region of Mt. Hermon where the soil is derived from disintegrating volcanic material which holds the moisture from the winter rains and sustains the plants throughout the growth season. For this reason it has been suggested (Huzayyin 1956) as the area in which wheat cultivation began. In the Central Plains of North America, sites west of the 99th meridian appear to be associated with old soil horizons that represent former humus lines and land surfaces subsequently mantled with aeolian deposits (Wedel 1953). Although historic agriculturists stayed east of this line within the 20-inch rainfall limit, the area west of it could maintain small scattered farming groups along the rivers.

Even though no physical trace of evidence for agriculture may exist, it may be possible to assume it, on the basis of the site being within one of the more favorable ecological zones in relation to soil, water, vegetation, and rainfall. However, caution is advised, as the entire culture in an historical context must be considered before such assumptions can be made. Narr (1956) illustrates such a problem in connection with the Campignian culture of France. These people occupied the loess areas and consequently were assumed to be agriculturists contemporaneous with the Danubians. However, culturally they were more like those groups to the north in the woodlands who were hunters and gatherers. There is very little direct evidence for agriculture, a few isolated finds, and Narr questions the validity of the assumption that they practiced farming and stock breeding. He asks therefore, "whether the 'typical' Campignians were not a mere hunting and collecting population who preferred the loess soils because they supported a wooded country of a kind that facilitated their habitual way of life as hunters-collectors attached to a like environment" (Narr 1956: 143).

Evidences for Agriculture

A principal problem is the recognition of agriculture where it occurs. This is particularly difficult with sites of incipient agriculturalists, in many cases impossible with present techniques. Even in areas of known agricultural development, such as Mesoamerica, the interpretation of a site as representing an agricultural economy is often a mere assumption, not an inference from anything in the archaeological picture. Further, it is apparent from many archaeological reports that such an assumption stands as the sole statement about the subsistence patterns of prehistoric peoples. An attempt to analyze the ecological situation would usually be productive of further significant information, such as the relative degree to which agriculture was supplemented by hunting-gathering, the amount of food surplus

(inferred from storage structures), and the relative importance of crops and domestic animals. This is not to say that such interpretations can always be made, for some sites simply do not yield evidence on these questions. Yet the skillful archaeologist will make maximum use of the data available to him.

We discuss below 2 categories of evidence which permit definition of a given site as agricultural: direct evidence (including physical remains of plants and art representations of agricultural crops and practices); and indirect evidence (construction features, implements, and cultural features supported by an agricultural economy).

Direct Evidence

Plant Remains. Plants, because of their perishable nature, are not usually present in archaeological sites. Preservation of such remains is dependent upon either the element of chance or favorable environmental conditions. In the former category are included carbonization of actual remains and preservation of impressions of plants or seeds in pottery, while the latter includes preservation through dessication or continuous dampness.

Of the fortuitous types of perservation, carbonization is more common, perhaps due to frequent charring of food during preparation. The occurrence of plant impressions in pottery, usually due to accidental association of pottery with food materials prior to firing, is comparatively rare in most areas, probably because of the care with which pottery was manufactured. These 2 types of preservation, since they are not limited by climatic or other environmental factors, are distributed more or less uniformly throughout the world.

Preservation through dessication or continuous dampness, on the other hand, is restricted to those areas in which ideal climatic or environmental conditions exist. Thus dried plant remains are generally found only in arid regions such as the Southwest and sections of the Andes, the Near East, and Asia, or in isolated dry caves in otherwise temperate climates. Conditions of continuous dampness are somewhat less common, occurring usually only in bogs, such as those in Britain and Scandinavia, or in completely submerged sites such as those of the Swiss Lake Dwellers.

Special techniques for recovery of plant remains are few. Impressions on pottery and dessicated vegetal material need no special treatment, the latter requiring only careful handling. Carbonized material, since it is extremely friable, should be handled with care, and use of a preservative, such as paraffin or a thin solution of ambroid, may be desirable. Remains of this type are best stored in glass vials, protected with cotton. Remains which have been preserved in continuous dampness require more delicate handling, since sudden exposure to air or too rapid drying usually results in destruction of the specimen. It is generally advisable to keep such remains in liquid until they can be dried slowly in the laboratory, after which application of a preservative may be undertaken.

Assuming that actual plant specimens are recovered from a site, the first level of analysis is recognition of domesticated varieties. This type of identification is best left to the botanist, since descriptive manuals do not generally present in sufficient detail the criteria necessary for separation of domesticated from wild plant species. Although botanical manuals list a number of species as domesticated plants, there is usually no indication of the reason for such listing, nor do illustrations show clearly the differences between domesticated and wild types.

There is, however, one criterion which the archaeologist may use in identifying domesticated plants; this is a noticeable increase in over-all size and/or yield in domesticated as compared with wild species. Domesticated species appear to tend toward larger plant structure and increase in number and size of fruits or tubers, as in the tomato and potato; smaller seeds and larger quantity of edible material, as in the cucurbits; or increase in cob or stalk size and number of kernels per stalk, as in maize and other cereal grains. While size increase may be used as an indicator of domestication at a general level, more precise identification by a botanist is usually desirable.

Although the primary emphasis in analysis of plant materials may be on cultivated species, the wild plants should not be overlooked. In the incipient stages of agriculture, gathering of wild plants often plays an important role in the economy, particularly during the period in which the cultivated plants have not yet been fully stabilized. Although gathering of this type may continue throughout the more advanced stages of agriculture (Clark 1952: 115-6), its importance usually decreases as the base of cul-

TABLE 1.

CHECKLIST OF

CULTIVATED PLANTS

	ANDES	TROP. S. A.	MAYA AREA	MEXICO	S. W. U. S.	EAST U. S.	EUROPE	NEAR EAST	S. E. ASIA	ASIA
Seeds, grain										
Amaranthus caudatus, Plumed amaranth		X								
Amaranthus paniculatis, Ragweed		AE	Eth		X		AE			
Ambrosia sp.						X				
Arena sativa, Oats								AE		
Bromus mango, Chilean mango			Eth							
Chenopodium album								AE		
Chenopodium nuttaliae, Pigweed					X					
Chenopodium pallidicaule, Canahua			Eth							
Chenopodium quinoa, Quinoa		AE	Eth							
Helianthus annuus, Sunflower						X				
Helianthus tuberosus, Jerusalem artichoke						X				
Hordeum distichum, Barley									AE	
Hordeum hexastichum, 6-Row Barley								AE	AE	
Hordeum vulgare, Quadrangular Barley								AE	AE	
Iva sp.						X				
Lupinus taurus, Lupine		R								
Madia sativa, Madi			Eth							
Oryza sativa, Rice									ETA	ETA ETA
Panicum mileaceum, Millet								AE	ETA	AE
Panicum sonorum			Eth							
Phaloris sp.						X				
Salvia hispanica, Chia			Eth		X					
Secale cereale, Rye								AE		
Sesamum indicum, Sesame									ETA	ETA
Triticum compactum, Dwarf wheat								AE		
Triticum dicoccum, Emmer									AE	AE
Triticum monococcum, Einkorn								AE		
Triticum spelta, Spelt								AE		
Triticum vulgare, Bread wheat								AE	AE	ETA ETA
Zea mays var. amylacea, Flour-corn		X			X					
Zea mays var. everta, Pop-corn					X	AE				
Zea mays var. indentata, Dent corn					X	AE	AE			
Zea mays var. indurata, Maise		AE			AE,R	AE				
Zea mays var. saccharata, Sweet corn					X					
Zea mays var. tunicata, Pod corn			Eth			AE				
Fruits										
Achras zapote, Sapodilla			Eth		X					
Amygdalus persica, Peach										ETA
Ananas sativa, Pineapple			Eth							
Anona glabra L., Articu do Brejo			Eth							
Annona muricata, Soursop		ETA			X					
Annona reticulata, Chirimoya					X					
Bagassa guianensis, Tatajuba			Eth							
Bellucia imperialis, Araca de anta			Eth							
Bixa orellana, Achiote			Eth							
Buchosia armeniaca		X								
Byrsonima crassifolia, Nanchi					X					
Calocarpum mommosum, Zapote			Eth		X					
Carica papaya, Papaya		X	Eth							
Caryocar Villosum, Piquia			Eth							
Casimiroa edulis, White zapote					X					
Casimiroa sapota			X							

TABLE 1

CHECKLIST OF

CULTIVATED PLANTS (Continued)

	ANDES	TROP. S. A.	MAYA AREA	MEXICO	S. W. U. S.	EAST U. S.	EUROPE	NEAR EAST	S. E. ASIA	ASIA
Fruits (cont.)										
Chrysobalamus icaco, Icaco		×								
Chrysophyllum caimito, Caimito					×					
Cocos nucifera, Palm			Eth							
Couma utilis, Sorva-pequena			Eth							
Craetegus mexicana, Tecojote					×					
Cyclanthera explodens, Pepino hueco					×					
Cyclanthera pedata			Eth							
Cydonia oblonga, Quince									ETA	
Cyphomandra betacea, Tree tomato			Eth		×					
Diospyros ebenaster, Black zapote					×					
Eugenia edulis, Cambuca			Eth							
Euterpe oleracea, Acai			Eth							
Feijoa sellowiana			Eth							
Ficus carica, Fig									×	Eth
Fragaria chiloensis, Chiloe strawberry			Eth							
Giulielma atilis, Peach palm			Eth							
Gonoglobis edulis, Cuayote					×					
Heliconia sp., Pacova (plantain)			Eth							
Lucuma obovata, Caimito		R								
Lucuma rivioca Gaertn., Cutitiriba			Eth							
Lucuma salicifolia, Yellow zapote					×					
Lycopersicum esculentum, Tomato		R	Eth							
Lycopersicum pimpinellifolium, Tomato					×					
Malpighia glabra, Cerejeira do Para			Eth							
Malus sp., Apple								AE		
Mammea americana, Mamey			Eth							
Mangifera indica, Mango									×	
Matisia cordata, Sapota do Peru			Eth							
Mauritia vinifera, Buriti			Eth							
Melicocca bijuga, Mamoncillo		×								
Musa paradisiaca normalis, Plantain		ETA	Eth							
Musa paradisiaca sapientum, Banana										
Myrciaria jaboticaba, Jaboticaba			Eth							
Oenocarpus bacaba, Bacaba-acu			Eth							
Opuntia sp., Nopal cactus					×					
Parmientiera edulis		×								
Passiflora edulis, Passion fruit			Eth							
Persea americana, Avocado		AE,R								
Persea gratissima, Avacado					×					
Phoenix dactylifera, Date									AE	ETA
Phylocalyx luschnatianus, Pitombo			Eth							
Physalis aequata, Husk tomato					×					
Physalis angulata, Tomato			Eth							
Physalis peruvianum, Peruvian berry		×								
Pithecolobium dulce, Guama		AE,R								
Platonia insignis, Bacuri			Eth							
Poraqueiba sericea, Umari			Eth							
Prunus armeniaca, Apricot									×	
Prunus capuli		×								
Prunus serotina, Capuli					×					
Psidium guayava, Guava					×					
Punica granatum, Pomegranate									R, ETA	

TABLE 1

CHECKLIST OF

CULTIVATED PLANTS (Continued)

	ANDES	TROP. S. A.	MAYA AREA	MEXICO	S. W. U. S.	EAST U. S.	EUROPE U. S.	NEAR EAST	S. E. ASIA	ASIA
Fruits (cont.)										
Pyrus communis, Pear										ETA
Rollinia orthopetala, Biriba			Eth							
Sapindus esculentus, Pitomba			Eth							
Sechium edule, Chocho					×					
Sicana odorifera, Melon casaba			Eth							
Solanum muricatum, Pepino		×	Eth							
Solanum quitoense, Naranjilla		×	Eth							
Spondias mombin, Hog plum			Eth							
Spondias purpurea, Ciriula		ETA	Eth							
Tacsomia mollissima, Curuba		×								
Talisia esculenta, Olho de boi			Eth							
Theobroma grandiflorum, Cupu-acu ver.			Eth							
Vitis sp., Grape								AE		
Ximenia americana L., Ameixa do Para			Eth							
Melon									AE	
Legumes										
Canavalia ensiformis, Jack bean		AE,R				AE				
Dolichos lablab, Lablab bean		AE								
Inga Feuillei, Tree legume		×			×					
Lens esculenta, Lentil								AE		
Pachyrhizus sp., Jicama		AE,R			×					
Phaseolus acutifolius, Tepary bean					×					
Phaseolus lunatus, Lima bean		AE,R			×					
Phaseolus multiflorus, Scarlet runner					×					
Phaseolus vulgaris, Kidney bean		AE	Eth		×	AE				
Pisum sativum, Pea								AE		
Prosopis edulis, Pod mesquite					×					
Vicia faba var. celtica, Celtic bean								AE		
Root crops										
Arracacia xanthorriza, Arracacha		×	Eth							
Canna edulis, Achira		R								
Colathica allonia					×					
Dioscorea trifida, American yam		R								
Dioscorea sp., Sweet potato										
Ipomoea batatas, Sweet potato		AE,R	Eth		×					
Manihot aipi, Sweet manioc		AE,R								
Manihot ultissima, Sweet manioc			Eth							
Oxalis tuberosa, Oca		×								
Solanum andigenum, Potato		AE,R								
Solanum juzepczukii, Luki			Eth							
Solanum columbianum, Columbian potato		AE,R								
Solanum tuberosum, Potato										
Tigridia pavonia, Cacomite					×					
Tropaeolum tuberosum, Mashua		×	Eth							
Ullucus tuberosus, Ulloco		×	Eth							
Xanthosoma belophyllum			Eth							
Xanthosoma brasiliensi			Eth							
Xanthosoma caraca			Eth							
Xanthosoma mafaffa			Eth							
Xanthosoma sagittifolium, Malanga		×								
Xanthosoma violaceum			Eth							

TABLE 1

CHECKLIST OF

CULTIVATED PLANTS (Continued)

	ANDES	TROP. S. A.	MAYA AREA	MEXICO	S. W. U. S.	EAST U. S.	EUROPE	NEAR EAST	S. E. ASIA	ASIA	
Narcotics, stimulants											
Agave americana, Agave (pulque)					×						
Camellia sinensis, Tea											
Catha edulis, Qat									×		
Cinchona calisaya, Cinchona	AE										
Coffea arabica, Coffee									×		
Erythroxylon coca, Coca	AE,R		Eth								
Ilex paraguensis, Herva-mate tea			Eth								
Ionidium ipecacuanha, Ipecac			Eth								
Jatropha aconitifolia, Chicasquil					×						
Nicotiana rustica, Tobacco			Eth		×						
Nicotiana tabacum, Tobacco		×	Eth								
Spices											
Capsicum annuum, Aji pepper		ETA									
Capsicum frutescens, Malagueta pepper			Eth								
Capsicum pubescens, Red pepper		×									
Eugenia aromatica, Clove										ETA	
Lepidium Meyenii, Pepper grass		×									
Maranta arundinacea, Araruta (arrow-root)			Eth								
Myristica fragrans, Nutmeg										ETA	
Nardostachys jatamansi, Spikenard										ETA	
Piper betle, Betel											
Piper caudatum, Nhandu			Eth								
Piper cubeba, Cubeb										ETA	
Piper nigrum, Black pepper										ETA	ETA
Schinus molle, Pepper tree		ETA									
Tagetes minuta, Cravo			Eth								
Zingiber Officinale, Ginger										ETA	ETA
Zingiber sp., Galingale										ETA	
Cloth, fiber											
Agave sisalana, Sisal					×						
Cannabis sativa, Hemp										ETA	
Fourcroya cubensis, S. Am. Agave		×									
Gossypium barbadense, Cotton		R							AE		ETA
Gossypium brasiliensis, Braz. cotton			Eth								
Gossypium hirsutum, Cotton		AE			AE,R	AE					
Gossypium peruvianum, Cotton		AE									
Gossypium vitrifolium, Cotton		AE									
Linum usitatissimum, Flax								AE	AE		ETA
Morus alba, White mulberry											×
Nuts											
Anacardium occidentale, Cashew			Eth								
Arachis hypogaea, Peanut		AE,R	Eth								
Arachis nambyguarae, Hoehne Giant Peanut			Eth								
Caryocar amygdaliferum, Almond		×									
Juglans niger, Black walnut											
Juglans regia, English walnut									×		
Pistacia vera, Pistachio											ETA
Prunus amygdalus, Almond											ETA
Miscellaneous vegetables											
Chamaedorra bifurcata, Pacaya					×						
Chayote edulis, Chayote			Eth		×						
Cissus sp., Kupa (creeper)			Eth								

TABLE 1

CHECKLIST OF

CULTIVATED PLANTS (continued)

	ANDES	TROP. S. A.	MAYA AREA	MEXICO	S. W. U. S.	EAST U. S.	EUROPE U. S.	NEAR EAST	S. E. ASIA	ASIA
Miscelleneous vegetables (cont.)										
Crescentia cujete, Calabash-tree					×					
Cucumis anguria, Pepino de sabana			Eth							
Cucurbita cyclanthera, Squash										
Cucurbita ficifolia, Malabar gourd					R(C)					
Cucurbita maxima, Hubbard squash			Eth							
Cucurbita moschata, Crook-neck squash		AE,R	Eth		×	AE				
Cucurbita pepo, Pumpkin		AE								
Cucurbita pepo, Summer squash		AE			×	AE				
Cucurbita sechium, Squash										
Cucurbita sicana, Squash		AE,R								
Cyathea arborea, Tree-fern (buds eaten)					×					
Erythrina edulis, Coral bean (blossoms)					×					
Hymenaea courbaril, Jatoba pods			Eth							
Inga edulis, Tree legume (pods)			Eth							
Lagenaria siceraria, Bottle gourd		AE,R			R(C)	AE				
Lupinus mutabilis, Bolivian lupine		×								
Momordica charantia, Pepino amarillo		AE,R								
Phytolacca decandra, Calahi (spinach)					×					
Rheum rhaponticum, Rhubarb										ETA
Miscellaneous										
Bombax aquaticum, Mamorana			Eth							
Bromelia pinguin, Pinula (hedge)					×					
Bunchosia sp.,			Eth							
Caesalpina sappan, Brazilwood (dye)									ETA	
Bambusa sp., Bamboo										
Cameline linicola, Cameline								AE		
Cereus sp., Hedge plant					×					
Genipa americana, xagua (dye)			Eth							
Hevea brasiliensis, Para rubber			Eth							
Indigofera suffruticosa, Indigo		AE							ETA	
Myrtus anayan,			Eth							
Nopalea coccinellifera, Cochineal cactus					×					
Olea europa var. Sativa, Olive								AE	AE	
Saccharum officinarum, Sugar cane										
Polakowska tacaco, Tacaco					×					
Polygonum sp.								AE		
Polymnia edulis, Yacon			Eth							
Polymnia sonchifolia, Llacon (Leaf-cup)		×								
Rheedia madruno, Madrono			Eth							
Theobroma cacao, Cacao		AE,R	Eth		R(C)					
Teca		ETA								
Papover somniferum, Poppy (seeds)								AE		
Crocus Sativus, saffron (dye)								AE	AE	

× Listed in sources; nature of evidence not stated
AE Known from actual specimens recovered archaelogically
Eth Known from ethnographic sources
R Known from reproductions or copies
ETA Early travelers' accounts

tivated plants is broadened. For this reason, the presence of quantities of wild plant foods in a site in which domesticated species are found may in many cases be indicative of the nascent stages of an agricultural economy.

The identification of cultivated plants is often made difficult by the fact that the line of distinction between domesticated and wild species is thinly drawn; for sites in which domesticated plants occur in a wild state as well, recognition of remains of cultivated plants may be virtually impossible. Since it is in such areas that cultivation of the plant is most likely to have begun, the archaeologist will be vitally concerned with the evidence for the beginnings of agriculture. In the absence of remains of datable fields or terraces, the archaeologist may be forced to base recognition of agriculture upon the presence of cultigens, or plants which appear only in domestication and are unknown in a wild state. The difficulty in using this type of evidence is that cultigens appear only after the agricultural economy has been developed for some time. Hence, while the presence of cultigens is indicative of an agricultural economy, it is not useful as an indicator of incipient agriculture.

If the plant materials admit identification of cultivated species, analysis may be carried farther, to the level of identification of types or races. Again, recourse to analysis by a botanist is advisable, since the data necessary to identification of races of domesticated plants are not usually contained in botanical handbooks and manuals. In general, races of cultivated plants are characterized by a group of traits which serve to separate distinguishable entities within a species. These may be named according to their suggested area of origin, and are usually used in analyses of diffusion and spatial relationships. Studies of this type dealing with archaeological materials have largely been restricted to races of maize in the New World, primarily because this grain is the most abundant among the remains of cultivated plants. Among analyses of races of *Zea mays* are those by Anderson and Cutler (1942), Manglesdorf and Smith (1949), Jennings and others (1956), and Carter (1945).

Identification of races of cultivated plants is often closely tied to studies of origin and diffusion, which are concerned mainly with earliest appearances of given races in various areas, aiming at tracing the races to their ultimate areas of origin. Notable among analyses of origin and diffusion are those by Manglesdorf and Reeves (1939), Sauer (1950), and Carter (1945). Origins are also analyzed in terms of areas of occurrence of wild precursors of domesticated species. These studies, which do not usually deal with races of plants, have been presented by numerous authors, including Coon (1943) and Dyson (1953b).

The accompanying chart (Table 1), which is an attempt to list all known cultivated plants and the evidence for their presence in various areas of the world, does not deal specifically with problems of spatial relationships, but aims rather at indicating to the archaeologist which plants he may expect to find in excavating sites in various regions of the world. Plotting distributions, either of numbers of plants or of a given species, is of little value in dealing with this material, since, with the exception of European remains, the greatest numbers of plants known from physical remains occur in areas in which climatic conditions result in preservation of perishable materials. Table 2 shows, as would be expected, that the greatest numbers of plants known from physical remains are found in the Andean area, Europe, and the Near East. While the first and last are the results of climatic conditions, the high number of plants recovered from European sites seems to be indicative of painstaking archaeological techniques.

TABLE 2. AREAL DIFFERENCES IN THE PRESERVATION AND RECORDING OF PLANT REMAINS.

Area	*Number of plants known from actual evidence*
Andes	28
Tropical South America	0
Maya	0
Mexico	2
Southwestern United States	10
Eastern United States	2
Europe	21
Near East	11
Southeast Asia	0
Asia	2

Differential preservation is evidenced by the listing of the number of plants from each category known from physical remains (Table 3). There is a predictable weighting in favor of the cereal grains, which are least subject to deterioration, with legumes, also better suited to preservation, being next.

TABLE 3. CULTIVATED PLANTS KNOWN FROM PHYSICAL REMAINS.

Seeds, grain: 19
- *Amaranthus paniculatis*, Plumed amaranth
- *Arena sativa*, Oats
- *Chenopodium album*
- *Chenopodium quinoa*, Quinoa
- *Hordeum distichum*, Barley
- *Hordeum hexastichum*, 6-Row Barley
- *Hordeum vulgare*, Quadrangular Barley
- *Panicum mileaceum*, Millet
- *Secale cereale*, Rye
- *Triticum compactum*, Dwarf wheat
- *Triticum dicoccum*, Emmer
- *Triticum monococcum*, Einkorn
- *Triticum spelta*, Spelt
- *Triticum vulgare*, Bread wheat
- *Zea mays* var. *everta*, Pop-corn
- *Zea mays* var. *indentata*, Dent corn
- *Zea mays* var. *indurata*, Maize
- *Zea mays* var. *tunicata*, Pod corn
- *Papover somniferum*, Poppy

Fruits: 6
- *Malus* sp., Apple
- *Persea americana*, Avocado
- *Phoenix dactylifera*, Date
- *Pithecolobium dulce*, Guama
- *Vitis* sp., Grape
- Melon

Legumes: 8
- *Canavalia ensiformis*, Jack bean
- *Dolichos lablab*, Lablab bean
- *Lens esculenta*, Lentil
- *Pachyrhizus*, sp., Jicama
- *Phaseolus lunatus*, Lima bean
- *Phaseolus vulgaris*, Kidney bean
- *Pisum sativum*, Pea
- *Vicia faba* var. *celtica*, Celtic bean

Root crops: 4
- *Ipomoea batatas*, Sweet potato
- *Manihot aipi*, Sweet manioc
- *Solanum andigenum*, Potato
- *Solanum columbianum*, Columbian potato

Narcotics, stimulants: 2
- *Cinchona calisaya*, Cinchona
- *Erythroxylon coca*, Coca

Spices: 0

Cloth, fiber: 5
- *Gossypium barbadense*, Cotton
- *Gossypium hirsutum*, Cotton
- *Gossypium peruvianum*, Cotton
- *Linum usitatissimum*, Flax
- *Gossypium vitrifolium*, Cotton

Nuts: 1
- *Arachis hypogaea*, Peanut

Miscellaneous vegetables: 6
- *Cucurbita moschata*, Crook-neck
- *Cucurbita pepo*, Pumpkin
- *Cucurbita pepo*, Summer squash
- *Cucurbita sicana*, Squash
- *Lagenaria siceraria*, Bottle gourd
- *Momordica charantia*, Pepino amarillo

Miscellaneous: 6
- *Cameline linicola*, Cameline
- *Indigofera suffruticosa*, Indigo
- *Olea europa* var. *sativa*, Olive
- *Polygonum* sp.
- *Theobroma cacao*, Cacao
- *Crocus sativus*, Saffron

240 species listed in Table 1. 57 known from physical remains, 23.75%.

Pollen Analysis. A different sort of physical remains can sometimes be found through pollen analysis. Even when pollen of domesticated plants is not itself recovered, indications of farming activity can sometimes be recognized in analysis of pollen samples. This is because an important operation required of agricultural communities is land clearance for cultivation. Attempts have been made to use pollen analysis to reconstruct primeval land clearance (Iverson 1956), and 3 stages, determined by pollen frequency, have been delimited from the Danish peat bogs. These stages probably apply only to the northern temperate zone. In the first stage of the revegetating of a clearing, the pollen of herbaceous plants shows a sharp increase. Cereals and new weeds emerge, particularly plantain. The vegetation then obtains a growth of tree forms — willow, aspen, and birch. Ground cover in this stage is comprised of grasses, white clover, sheep sorrel, and sheep's-bit. The third phase is marked by the return of the big-tree forest. This forest, however, differs from the virgin forest by a greater dominance of oak, and a decline of elm and linden.

Pollen analysis can also give indications of the way the forest was cleared. The presence of birch in the second stage of reforestation is significant in that birch succeeds a mixed oak forest only after burning. Iverson has also isolated 3 species of moss that are "fire indicators." Unfortunately, moss spores are small in size and difficult to identify in a pollen sample.

It should be pointed out that forest clearance does not necessarily imply land use for agriculture. Stewart (1956) states that numerous nonagricultural groups employed fire in forest

management. Natural factors, such as volcanic eruption and meteorites, could start extensive forest fires. However, the use of the above technique,allowing for these possibilities, may prove a valuable indicator for primeval land use.

Firbas (1937) has demonstrated that cereal and wild grass pollens could be distinguished. Applying this technique on pollen remains in Danish peat bogs, he identified the following domesticated cereal grains, *Secale* (rye), *Triticum* (wheat), *Arena sativa* (oats), and *Panicum miliaceum* (millet). Excepting rye, difficulties in obtaining high pollen curves were encountered. This was due to the self-pollinating features of cereal grains.

Representations of Agriculture. The use of domestic plants and animals can be inferred from various kinds of art representations. These include not only murals and petroglyphs, but also designs and shapes of clay and metal objects. Many of these are undoubtedly of a religious nature and reflect the important role of agriculture in these early cultures.

Some plants are depicted with sufficient clarity and accuracy to permit specific identification, for example, a pottery vessel from Peru that has lima beans painted on it for decoration (Kroeber 1953) and gold pomegranate flowers and fruits from Ur (Woolley 1950).

In some areas of poor preservation, such as the Mayan, the only direct evidence for agriculture may be representative. Many times, also, it would not be possible to reconstruct the actual agricultural or husbandry practices from the artifacts or animal bones themselves; it is the scenes depicted in the various representations alone that will give us an accurate picture, for example, the Ur frieze of a milking scene, or the Swedish rock engravings showing the manner of plowing with a 2-oxen team (Table 4).

Indirect Evidence

Agricultural Implements. A number of artifact types have been considered evidence for agriculture. However, incipient agriculturalists apparently made use of existing tools and techniques, and therefore the assemblage of small tools does not necessarily change with the shift from gathering to agriculture (Braidwood 1950: 88-9; Clark 1953: 74). Artifacts representing unquestionable agriculture (such as plows) do not occur until well developed agricultural societies have developed.

Old World prehistorians have often equated polished stone chopping tools to the Neolithic period and agriculture. This is based on the inference that polished chopping tools were utilized for forest clearance to provide arable land (Childe 1951: 75-6). However, polished stone tools have been used by nonagricultural peoples, such as those of northwestern North America, where these tools were used for canoe making and wood carving (Olson 1927). On the other hand, the Mesoamerican center of agriculture seems to have retained chipped stone tools throughout its history; although jade celts occur, the common chopping implement appears to have been a chipped flint ax. Hence, polished stone tools are not necessary evidence for agriculture in all areas.

Another implement often correlated with agriculture is the sickle. However, the invention of the sickle appears to have been in response to the need for grass cutting based on a gathering economy. The earliest record of sickles is from the Natufian of Palestine (Garrod 1932) but there is some dispute as to whether these sickles were used for agriculture instead of for cutting wild grasses. Whale bone sickles were used by the nonagricultural Kamchadal and probable sickles of mountain sheep horn occur in the Great Basin of North America in a gathering context (Heizer 1951).

The sickle was early adapted to agriculture in the Near East, but not until around 200 B.C. was any technological improvement (other than change to metal) made. At this time the balanced sickle appears in the Alps and Transylvania. The short-handled scythe first appears in the Roman Iron Age in Denmark (Curwen and Hatt 1953: 112-6).

In both Old and New Worlds, grinding implements were originally developed for grinding wild seeds and the same implements were later adapted to grinding agricultural products. Thus, despite some Old World prehistorians (Raftery 1951: 81), grinding implements are not in themselves evidence for agriculture, although the legged metate seems to be associated with florescent agriculture in the New World (Woodbury 1939: 63-8). Other implements of hunting-gathering groups which were transferred to agricultural use include the dibble (an unmodified digging stick) and the hoe (perhaps an adaptation of the adz).

In sum, there seems to be no tool type that serves to mark the transition from hunting-

TABLE 4. REPRESENTATIONS OF DOMESTIC PLANTS AND ANIMALS AND ECOLOGICAL PRACTICES.

Place	*Plants*	*Animals*	*Practices*
Ur Woolley 1950	ears of "corn" pomegranate flowers and fruit (gold hair ornaments)	cattle, goats, ass, sheep (depicted on frieze)	milking cows (frieze)
Sumer Clark 1953			traction-plow (seal engraving)
Erech Frankfort 1951	ear of barley (cylinder seal)	sheep, bulls (cylinder seal)	sheep in fold (sculptured trough)
Egypt Clark 1952; Frankfort 1951		oxen, ass (tomb painting)	cutting grain, using plow (painted scenes in tombs)
Khurab, Persia Albright 1949		camel (bronze relief)	
Kulli, Baluchistan Albright 1949		horses, humped cattle (clay figurines)	
Jericho, Palestine Albright 1949		sheep, cattle, goats pigs (statues)	
Megiddo, Palestine Albright 1949		horse (horse-drawn chariots on ivory)	
Yenesei, Siberia Gaul 1943		oxen, camel, horse, sheep (metal work)	
Mexico (Aztecs) Vaillant 1944	corn, cacao bean, gourds, cotton (codices)	hairless edible dog (pottery) turkeys (codices)	planting corn with dibble stick (codices)
Peru Bennett 1946 Kroeber 1953 Lehman 1924	lima beans (painted design on pottery) maize, fruit, gourds (pottery shapes and decoration)	duck (pottery) guinea pig, llama (clay figurines)	
Southern Sweden Clark 1952		oxen (rock engraving) horse (slab engraving)	man plowing with ox team (rock engraving)
Cyprus Clark 1952		oxen (clay model)	men and ox team plowing (clay model)

gathering to agriculture; all the tools that are definite indicators of agriculture were developed long after agriculture itself appeared.

Architectural Features. Architectural features such as ditches and canals, terraces, irrigated plots, and granaries or storage structures of some kind, are usually taken to be evidences of agriculture wherever found. Each individual agricultural complex did not contain all these features. For example, terraces are a specialized technique and do not always appear wherever agriculture was practiced. Although in many instances there is no clear evidence for the manner in which the water supply was controlled, such as canals, in all cases storage structures seem to be present (Table 5). These may vary in form from slab-lined pits (Fremont) and straw-lined pits (Fayum) to silo types of granaries (Anasazi) and storage jars (Hassuna), but they appear to be present early in all agricultural communities. It is thus probable that the first architectural feature to appear at the beginnings of agriculture is the storage structure, reflecting the food surpluses that were becoming available. Extensive canal patterns and terracing would appear only in a fully de-

veloped agricultural economy. A possible illustration of incipient agriculture is found at Hassuna in Mesopotamia (Perkins 1949) where the lowest level does not contain any sickle teeth, ovens, or granaries (storage jars). However large straw-tempered pottery jars are found whose only apparent use is for child burial. In this level one cannot say for sure if agriculture was present. In the next level sickle flints, ovens, and storage bins are found. These bins are exactly like the previous level's large jars and had been sunk in the ground and used for grain storage, for they still held decayed chaff and carbonized grain.

The prevalence of storage structures is clearly shown in Table 5. It seems reasonable to infer agriculture when storage structures are present; further, such structures apparently are found in very early agricultural communities. There are some exceptions to this generalization, such as the cists of the Great Basin (Meighan 1953: 175-6), but storage structures seem to have greater significance than is generally recognized.

TABLE 5. ARCHITECTURAL FEATURES RECORDED ARCHAEOLOGICALLY

Culture Area or Site	*Ditches, Canals*	*Terraces*	*Irrigated Plots*	*Storage Structures*
Hohokam Haury 1956	X			X
Anasazi Morris 1939				X
Mogollon Wheat 1955				X
Fremont Wormington 1955				X
Maya Thompson 1939		X		X
Mexican Highlands Vaillant 1944	X			X
Andean Highlands Bennett 1946	X	X		
Peruvian Coast Willey 1953	X	X	X	X
Fayum Braidwood 1950				X
Merimde Braidwood 1950				X
Nile Delta Frankfort 1951	X			X
Sumer Frankfort 1951	X			X
Hassuna Perkins 1949				X
Mohenjo-Daro Albright 1949				X
Danubian (Köln-Lindenthal) Clark 1953				X

Traits Supported by an Agricultural Economy. In examining known agricultural sites, we tried to discover physical evidences which are always associated with agricultural communities and hence might serve as indirect evidence for agriculture. These include features which can be supported (technologically, socially, or economically) only by an agricultural economy. In addition, it is likely that there are some artifact types that were simply not invented before the onset of agricultural practices, although we had little success in thinking of what these objects might be.

It developed that a number of traits which we tend to unconsciously associate with agriculture are not always so found. The following list includes traits which are known to occur in one or another hunting-gathering context, so that they may *not* be used as evidence for agriculture:

1. Smelting or use of metals
2. Trough metates
3. Digging sticks
4. Hoes
5. Sickles
6. Figurines, including those of clay
7. Polished chopping tools, including axes, adzes, and celts
8. Spindle whorls (used on Northwest Coast, Goddard 1934: 53-8)

A number of features developed by florescent agricultural communities may be recognized. These include such things as structured settlement patterns (towns laid out in blocks, plazas, and so forth), multi-storied buildings, pyramids, megalithic constructions, and such direct indications of agriculture as terraces and irrigation systems. It is probable that the absolute size of a site can also be used as indirect evidence of an agricultural economy; we were not able to define the size limit for nonagricultural communities, but hunting-gathering sites of greater than 10 acres extent seem to be exceedingly rare while even a small agricultural community may occupy this much area (Table 6).

Certain technological features that appear to be diagnostic of an agricultural community include the following:

1. Decorated pottery (there are rare exceptions)
2. Wheeled vehicles
3. Shaft tombs
4. Constructed ovens (not earthen pits)
5. Arches and vaults
6. Molds for casting (Linné 1934: 193-7, Appendix 6, for New World distribution)
7. Cylinder seals (Linné 1929: 38-51, for New World; Frankfort 1939, for Old World)
8. Lapidary work in stones harder than quartz
9. Pottery fired at high temperatures (dividing line not known)

Animal Domestication

One way man can become a food producer is by domesticating animals. However, it must be stressed that domestication may be for other reasons, such as pack, draft, riding, or pets (Table 7).

Generally speaking, in this paper, we consider an animal domesticated if it fulfills the following 2 requirements: (1) it is of economic value, and (2) it breeds in captivity. Certain

Table 6. Comparison of Areas, Agricultural versus Hunting-gathering Sites.

Region and Site	Period	Area (acres)
Crete: Gournia	Bronze age	6
Anatolia: Troy II	Bronze age	less than 2
Troy VI	Bronze age	4
Greece: Hagia Marina	Neolithic	15
Mycenae	Bronze age	11
Asine	Bronze age	9
Gla	Bronze age	24
Central Europe: Tangaru	Neolithic	1
Kodja	Neolithic	0.75
Ariusd	Neolithic	1.25
Spain: Los Millares	Chalcolithic	12.5
El Officio	Bronze age	2.5
Italy: Lagozza	Neolithic	0.5
France: Fort Harrouard	Neolithic	17
Bavaria: Altheim	Neolithic	0.75
Swiss Lakes: Moosseedorf	Neolithic	less than 0.25
Robenhausen	Neolithic	3
Irgenhausen	Neolithic	0.25
England: Skara Brae	Neolithic	less than 0.25
Whitehawk on Brighton	Neolithic	11.5
Windmill Hill	Neolithic	23
California: Omen	Hunting-gathering	ca. 0.2
Rekwoi	Hunting-gathering	5
Sac-6	Hunting-gathering	5.7
LAn-52	Hunting-gathering	6

Sources for the table include Childe 1931, 1950; Clark 1941; Cook and Treganza 1950; Keller 1878; Munro 1912. The 3 last-listed California sites are among the largest of west coast middens; the average area of 32 hunting-gathering sites listed by Cook and Treganza is only 1.25 acres. No direct comparison is implied by our selection of California sites and Old World sites although it is interesting to note that some of the California aborigines occupied settlements larger than fabled Troy. California, being a particularly favored area for hunters and gatherers, is used in the comparison because it may provide an upward limit for midden areas. From the fragmentary information available to us, we suggest that middens or site areas of greater than 10 acres extent are almost certainly supported by an agricultural economy.

The average area of the 13 neolithic sites listed in the table is 5.7 acres, almost 5 times greater than the California average even though there is much overlap between the 2 regions. Both sets of figures are probably weighted in the direction of the bigger sites because of the archaeologist's tendency to select larger sites for excavation and mapping. The true average size is no doubt considerably smaller for both regions.

TABLE 7. ANIMALS DOMESTICATED BY MAN. CRITERION: BRED IN CAPTIVITY PRIOR TO THE INDUSTRIAL REVOLUTION.

	Common Name	*Taxonomic Name*	*Primary Uses*	*Probable Origin*
1.	Dog	*Canis familiarus*	Pet, Hunting, Herding, Watching	Cen. Asia
2.	Dog	*Canis familiarus*	Transport	Circum-Polar
3.	Dog	*Canis familiarus*	Meat	New World
4.	Cat	*Felis domesticus*	Pet	Egypt
5.	Ox (Cattle)	*Bos taurus*	Draft, Dairy, Meat	Near East
6.	Zebu (Brahman)	*Bos indicus*	Draft, Dairy	India
7.	Yak	*Poephagus grannieus*	Draft, Dairy	Tibet
8.	Bali Cattle	*Bibos sondiacus*	Draft	SE Asia
9.	Water Buffalo	*Bubalus bubalus*	Draft	SE Asia
10.	Camel	*Camelus dromedarius* and *bactrianus*	Pack	Cen. Asia
11.	Llama	*Lama glama*	Pack, Meat, Wool	Andes
12.	Alpaca	*Lama pacos*	Wool, Meat	Andes
13.	Reindeer	*Rangifer tarandus*	Pack, Transport, Dairy, Ride	Siberia
14.	Sheep	*Ovis aries* and *vignei*	Meat, Wool	Near East
15.	Goat	*Capra hircus*	Meat, Dairy	Near East
16.	Elephant*	*Elephas indicus*	Transport, Ride	India
17.	Horse	*Equus caballus*	Pack	Cen. Asia
18.	Horse	*Equus caballus*	Draft, Ride	Near East
19.	Ass	*Equus asinus*	Pack, Draft	Africa
20.	Onager	*Equus hemionus*	Pack, Draft	Cen. Asia
21.	Swine	*Sus scrofa*	Scavange, Meat	Near East
22.	Swine	*Sus cristatus*	Scavange, Meat	SE Asia
23.	Rabbit	*Oryctolagus cuniculus*	Meat	Medit.
24.	Cavy (Guinea Pig)	*Cavia porcellus*	Meat	Andes
25.	Chicken	*Gallus domesticus*	Sacrifice, Fighting	SE Asia
26.	Chicken	*Gallus domesticus*	Poultry, Feathers	Europe
27.	Turkey	*Meleagris gallopavo*	Poultry, Feathers	Mesoam.
28.	Goose	*Anser anser*	Poultry, Feathers	Egypt
29.	Goose	*Cygnopsis cygnoid*	Poultry, Feathers	China
30.	Goose	*Alopochen aegyptiaca*	Poultry, Feathers	Egypt
31.	Duck	*Anas platyrhynchos*	Poultry, Feathers	Egypt, China
32.	Muscovy Duck	*Cairina moschata*	Poultry	So. Am.
33.	Pigeon	*Columba livia*	Poultry	Egypt
34.	Guinea Fowl	*Numida melegris*	Poultry	Africa
35.	Peacock	*Pavo cristalus*	Poultry, Decoration	India
36.	Swan	*Cygnus olor*	Decoration	Eurasia
37.	Honeybee	*Apis mellifera*	Honey, Wax	Eurasia
38.	Stingless Bee	*Melipona beechii*	Honey, Wax	Mesoam.
39.	Silkworm	*Bombyx mori*	Silk Fiber	China
40.	Cochineal	*Dactylopius coccus*	Dye	Mesoam.
41.	Lac Insect	*Lacciffer lacca*	Lacquer	No. India
42.	Antelope†	spp?	?	Egypt
43.	Mouse†	*Mus musculus*	Meat, Pet	China

* Not bred in captivity.
† Dobzahnsky, 1955: 193.

exceptions or partial exceptions included here are the elephant, dog, cat, and swan. Galton (1865) discusses various criteria of domestication. See Dyson (1953a) for a nearly complete list of domesticated animals.

Excluding the dog, whose domestication antedates that of other animals, 2 patterns of animal domestication developed. One pattern was associated with sedentary agriculturalists. Here animals were domesticated primarily as an adjunct to the agricultural food supply. They were either raised in pens and/or were exploited as power for agricultural food production as draft animals. If bones from animals primarily used in this way are excavated, one can probably assume agriculture for the inhabitants of the site.

The second pattern of animal domestication is associated with pastoral nomads. Here animals were also eaten, but their primary uses were for packing and riding. Animals domesticated by nomads, particularly if not used for food, are quite sparse in the archaeological record and one must be on guard not to assume the absence of domestication from negative evidence. The sparseness of horse remains in the plains illustrates this problem.

Two types of interpretation can be made from the animal remains of food producing communities. (1) Are the remains from domesticated animals? (2) What effects did the domestication of animals have upon the ecology?

One method of determining whether animals are domesticated is by bony structure. This method is not applicable to dogs (White 1955: 172). However, it can be used for animals exclusively kept by agriculturalists, since extensive morphological changes occur due to increased feeding and immobility. Pioneer work was done along this line by Rütimeyer (1862) for the Swiss Lake Dwellings. A translation of his work (Anonymous 1862: 362-3) summarizes:

> Critical comparison enabled science to distinguish the bones of wild from those of domestic animals. Those of the former exhibit a deep brown, almost black, color; a surface smooth and greasy to the touch, and in most cases a wonderfully increased specific gravity; more distinctly marked carinae; greater roughness, and more acutely cut muscle insertions — in short the greatest possible distinctness of all edges and protuberances, together with the least possible quantity of indifferent surfaces. On domestic animals the bony substance appears — if the expression may be allowed — more soft, spongy, and yielding to plastic impressions. We cannot doubt . . . that the new relations of life following the domestication of animals causes a weakening of all the energies of the system, by increased nourishment, and lessened exercise, and additional fattening. These are results, not of centuries, but of much shorter spaces of time.

Since Rütimeyer's time, almost no work has been done in qualitative bone study in regard to domestication. However, Cornwall (1957: 102) points out differences between the dentition of wild pigs and domestic pigs.

Dyson (1953a) suggests that the above observations might be supplemented by quantitative methods. A rapid rise in the number of bones of a particular animal would suggest breeding instead of hunting.

Bone remains can also be used to extract information about the customs of the husbandryman. Clark (1952: 117) shows by counting bone remains from various excavation levels at Trundle, Sussex, that the pig lost favor in Iron Age times while sheep and goat increased in popularity. From this type of information past dietary patterns can be inferred.

Methods of slaughtering can also be inferred. Childe (1931: 200-1) shows that nearly 3/5 of the cattle at Skara Brae, Orkney, were slaughtered at less than 6 months and that less than 1/5 reached maturity. The remainder were killed off at between 12 and 18 or between 30 and 36 months, suggesting a seasonal slaughtering pattern.

Materials, particularly bone, from domesticated animals increased the supply of raw materials that could be used for manufacturing articles. Examples of the use of these materials are sheep metapodal for bobbins at the Glastonbury lake-villages, and the use of horn in Bronze Age Europe for making daggers, hilts, combs, ladles, drinking vessels, and trumpets (Clark 1952: 225).

Not only can evidence of domesticated animals be obtained by recovery of their bony remains, but also by the recovery of paraphernalia that was specifically used by them (Table 8).

Conclusions for Part II

Our survey of archaeological knowledge relating to the domestication of plants and animals points to the following conclusions:

1. Present archaeological techniques provide no clear-cut methods for recognizing the incipient stages of either plant or animal domestication. There is a need for more intensive study

TABLE 8. DOMESTIC ANIMAL PARAPHERNALIA RECOVERED ARCHAEOLOGICALLY.

Draft gear	
Yokes	
	Petersfehn, Oldenburg (Sprockoff 1938: 136, Fig. 91)
	Vinelz on the Bielersee (Ischer 1928: 43-4, Taf. 7)
Ards	
	Europe (Curwen and Hatt 1953: 69-74)
Carts	
	Mesopotamia (Woolley 1950)
Equine trappings	
Bits, cheek pieces	
	Scythians (Minns 1913: 74-7)
	Yenesei Drainage (Gaul 1943)
Stirrups, saddle girth buckles	
	Yenesei Drainage (Gaul 1943)
Prick spurs	
	Trugny, Aisne (Dechelette 1914: 1202-4, Figs. 514-5)
Horse shoes	
	Early Roman Gaul (Ward 1941; Ward-Perkins 1941)
Halter	
	Ginderup, Denmark (Hatt 1937)
Reindeer trappings	
	Lake Baikal region (Mirov 1945)
Canine trappings	
Crossbars, sledge shoes, draught-line toggles, toboggan strips, whip shanks, trace buckles for harness	
	Thule (Mathiassen 1927, Pt. 1: 43-6, 160-2, Pls. 13, 45; Pt. 2: 60-3)
Stables	
	Ezinge near Groningen (Giffen 1936)
Turkey pens	
	Anasazi (Amsden 1949: 131)

of sites which combine hunting-gathering with plant and animal domestication, from the point of view of developing more refined techniques for recognizing domestication when it occurs.

2. A number of indirect methods may be applied to the question of plant and animal domestication (such things as storage structures reflecting agriculture or sudden increase of a particular species reflecting animal domestication). Such indirect methods could be expanded and codified, but the conclusions derived therefrom must be stated in terms of probabilities rather than as facts.

3. The fact that agriculture and animal-breeding are so difficult to demonstrate in their incipient stages argues strongly for a long and gradual transition from hunting-gathering societies. This has both chronological implications (agriculture older than now believed) and theoretical implications (the "revolution" theory not an accurate reflection of culture history).

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UNIVERSITY OF CALIFORNIA
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THE PLACE OF FINE ORANGE POTTERY IN MESOAMERICAN ARCHAEOLOGY

ROBERT E. SMITH

FINE ORANGE pottery is one of the most distinctive wares in Mesoamerica. In an area where pottery generally is tempered it has no temper; it stands apart in having an especially homogeneous, fine-textured orange paste. Several types are recognized, including, in chronological order, Z, Y, X, V, U, and the problematical Isla de Sacrificios material. It is possible that there are other fine oranges but there is not now sufficient evidence to establish additional types. The letters used to identify the varieties are temporary designations which should be replaced with appropriate names when more complete data have been amassed.

Presumably because of its distinctiveness and high quality, fine orange pottery had a wide vogue and geographic distribution for a period of approximately 700 years. However, this distribution and longevity are segmented by the occurrence of different types, each of which had its area of influence, its time span, and its diagnostic shapes, methods of decoration, and styles of design.

Z Fine Orange. This type is perhaps the oldest so far recognized. Brainerd (1941), who named and described it, placed it in the Puuc ceramic complex as a trade ware preceding X Fine Orange and Tohil Plumbate. It may, therefore, be placed at the end of the Maya Late Classic period or in a Late Classic to early Postclassic transitional phase (Tepeu 3 in the Uaxactún chronology). Recently Berlin (1956) encountered various types of fine orange on a survey of a wide area in Tabasco. In the Jonuta-Tecolpan region the main type was Z Fine Orange. There it is the most abundant type in the upper levels where it is closely associated with fine gray and black types. These were preceded by Classic Maya specimens of Tepeu 2 types. This would again tend to place Z Fine Orange on a Tepeu 3 or very late Classic horizon. Ruz Lhuillier (1945) encountered Z Fine Orange in fair quantity at Los Guarixes (Isla del Carmen), Campeche. This type of fine orange has been found in appreciable quantity, always in the upper levels, at Kabah and Uxmal in western Yucatán. Although many other sites in Mesoamerica may claim a few examples of Z Fine Orange, the center of concentration would appear to be somewhere in eastern Tabasco, possibly the Jonuta-Tecolpan region, or in southwestern Campeche near Los Guarixes.

The characteristic traits which identify Z Fine Orange include shape, method of decoration, and style of design. Shape is usually some segment of a sphere or ovaloid (Fig. 1 *a, b, d, e*), both deep and shallow, and with either restricted or open orifice. Other less common forms are the hemispherical bowl with ringstand (Fig. 1 *c*) and the barrel-shaped vessel (Fig. 1 *f*). The main methods used for decorating are incising (Fig. 1 *b*), plano-relief carving (Fig. 1 *c-e*), and painting (Fig. 1 *a*). The principal styles of design fall within the Maya Classic tradition. The human figure (Fig. 1 *d, e*) is usually portrayed by means of plano-relief carving. Scroll or scroll-like patterns are incised and often arranged in paneled bands in which one of the most consistent minor embellishments is a cursive M-like device (Fig. 1 *c*); in fact this style has a generally cursive quality. Broad black (Fig. 1 *e*), red (Fig. 1 *b*), or white stripes are often used as background for the incised or plano-relief motifs. Many of the vessels are coated on the interior or exterior or both with a highly polished white slip (Fig. 1 *c, d*). Some of the round-sided bowls (Fig. 1 *a*) have wavy red or brown interior borders.

Y Fine Orange. Uaxactún Fine Orange, which is now called Y Fine Orange, is described by Smith (1956) and belongs to Tepeu 3 which may well be a Late Classic to early Postclassic transitional period. There is evidence for this supposition which will be discussed in the final report on the Mayapán ceramics. Y Fine Orange has a spotty distribution; in addition to Uaxactún, it occurs at Kixpek, Nakum, Piedras Negras, San Agustín Acasaguastlan, and Seamay Cave in Guatemala; near Benque Viejo in British Honduras; Palenque and Yaxchilán in Mexico; San Salvador in El Salvador. So far it has not been encountered in the Yucatecan Peninsula, Tabasco, or Veracruz in Mexico, and therefore, although the origin is unknown, it is presumed to come from somewhere within an area roughly limited by southeastern Chiapas, eastern Tabasco, southern Campeche, western British Honduras, and the Alta Verapaz of

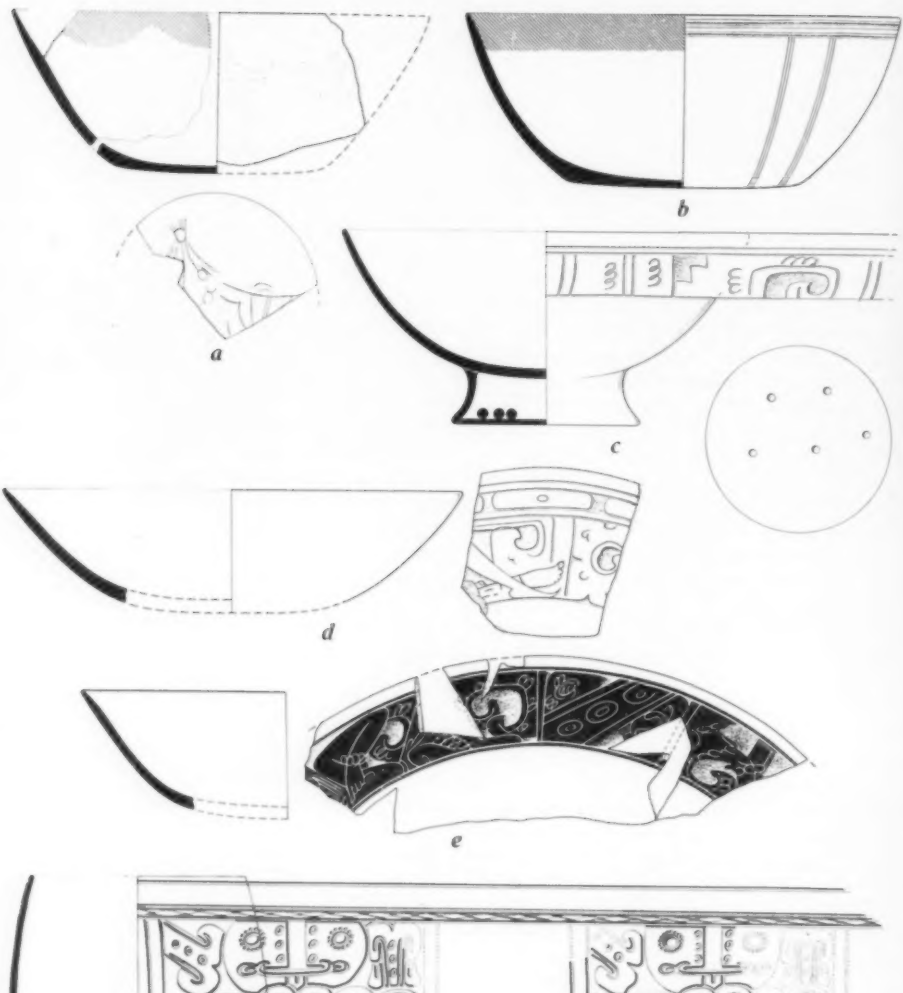

FIG. 1. Z Fine Orange vessels from Uxmal. *a*, scratching or doodling on base; *b*, incised decoration; *c*, white slip and rattle base; *d*, *e*, white slip; *f*, design a possible Serpent X motif (courtesy of Alberto Ruz Lhuillier). Height of *f*: 14 cm.

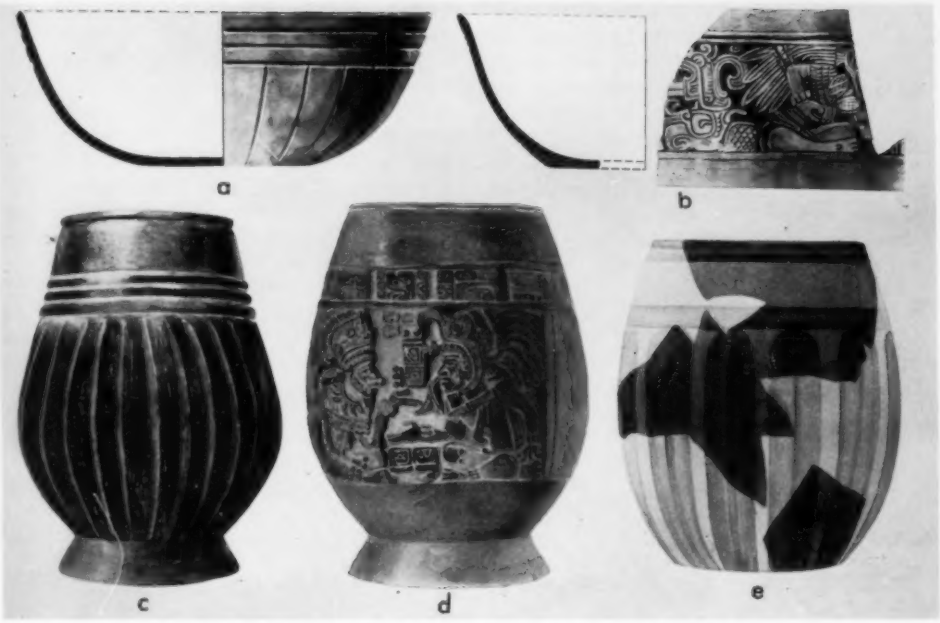

FIG. 2. Y Fine Orange vessels from Uaxactún. Height of *d*: 19.5 cm.

Guatemala. This would suggest the Petén of Guatemala, but it is unlikely that the proper clay was available in much of that limestone region.

The predominant form of Y Fine Orange, as in Type Z, is a shallow round-sided (Fig. 2 *a*) or flaring-sided (Fig. 2 *b*) bowl. There are 2 other shapes that are very characteristic of this type. These are the barrel-shaped ring-stand (Fig. 2 *c*, *d*) and barrel-shaped, flat-based (Fig. 2 *e*) vases. The chief methods used for decorating are modeled carving (Fig. 2 *b*, *d*), grooving (Fig. 2 *a*), gadrooning (Fig. 2 *c*), and painting (Fig. 2 *e*). The modeled-carving technique of decoration (Smith 1956: 43) was usually reproduced in a mold. The vertical halves of the vases were made in separate molds and welded together between panel sections to complete the vessels; a single mold was probably used for the shallow bowls. The principal types of design include carved glyph or glyph-like banding, carved panels of human figures, horizontal and vertical grooving which gives the effect of gadrooning worked from the exterior only, and thinly applied horizontal and vertical black striping.

X Fine Orange. This is probably the best known and best recognized type of fine orange, largely because sizable quantities have been found, and also because of Brainerd's (1941) excellent description. In a later study of the X type of design Brainerd (1953) suggests that X Fine Orange "seems most likely to have been made somewhere in Central Veracruz." A good deal of X Fine Orange has come from Chichén Itzá, Huaymil, and Champotón, lesser quantities from Jaina and Isla de Sacrificios. Ruz Lhuillier (1945) unearthed a fair sample of this type at Jaina and Champotón in Campeche. Alberto Márquez had a large collection in Mérida which he said was found mostly in Jaina and Huaymil (Smith 1957). Berlin (1956) found only a few examples throughout his considerable ceramic survey in Tabasco. Nuttall (1910), Medellín Zenil (1955), and especially DuSolier (1943) illustrate a number of typical specimens of X Fine Orange from Isla de Sacrificios, Veracruz. There they are associated with fine polychromes. When more material is available for technological analysis, it may be possible to identify several types of fine polychrome, including a fine orange type (Brainerd 1941, Pl. IV *b-f*), a Cerro Montoso or Isla de Sacrificios II type (Nuttall 1910, Pls. XI B, 950; XII C, 1104, 1105), and a fine buff type with buff

to light orange paste. The latter is similar to a few pieces from Cerro de las Mesas and Tres Zapotes (Drucker 1943a, 1943b), and to other untempered material from Mayapán (the one sherd examined by Shepard is untempered) and from Isla de Sacrificios which Medellín Zenil (1955) calls Cerro de las Mesas Superior. The occurrence of fine polychrome at Chichén Itzá is as rare as it is at Jaina, Huaymil, and Champotón. On Isla de Sacrificios it forms a far greater percentage, especially if the Isla de Sacrificios II (Medellín Zenil 1955) is included. On the basis of frequency of occurrence it would appear that X Fine Orange was probably made somewhere along the coast of Campeche whereas the majority of associated fine polychromes most likely have their origins in central and southern Veracruz.

The principal shape characteristics of X Fine Orange are the pyriform vase with 3 hollow, bulbous feet (Figs. 3 *b, c,* 4 *d, e*) or bell-shaped pedestals (Fig. 3 *a, f*); cylindrical vases with pedestals (Figs. 3 *d,* 4 *f*); globular jars (Fig. 3 *e*); flat-bottomed, basal-break tripod plates with hollow, bell-shaped feet (Fig. 4 *a*); round-sided bowls (Fig. 4 *c*); and convex-bottomed, basal-break tripods (Fig. 4 *b*). The methods of decoration are painting, gouging-and-incising, and modeling. Black painted step-frets with related elements, bands of black birds and black floral, serpent, or grotesque motifs, and gouged-and-incised scroll meanders and floral motifs, are

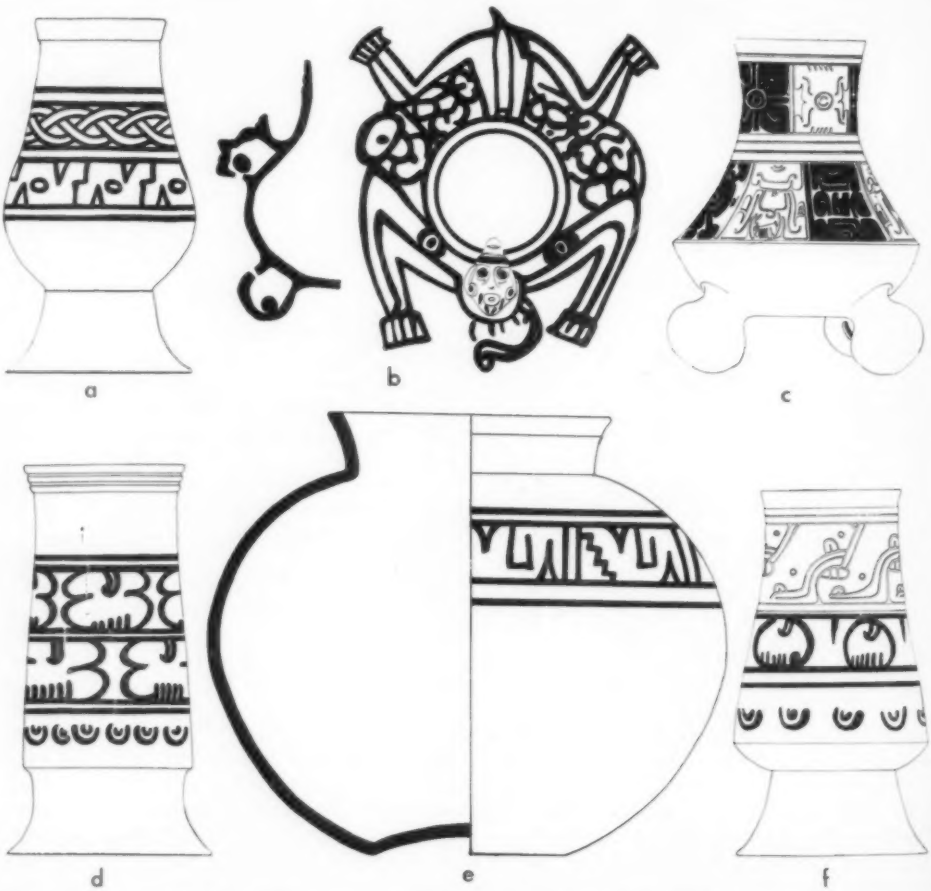

Fig. 3. X Fine Orange vessels from the Márquez collection. Height of *f*: 19.9 cm.

typical design treatments. There are also modeled effigy vessels representing animals or humans usually with attached modeled heads combined with black details (Fig. 3 *b*). The modeled technique was rarely accompanied by incising and then only when the limbs were modeled rather than painted. X Fine Orange has 4 main types of design: abstract, naturalistic, conventionalized, and glyphic. In general the painted abstract design patterns are in interlocking bifold rotational symmetry, the gouged-and-incised abstract patterns in slide reflection symmetry.

An unusual vessel (Fig. 4 *f*) from Moxviquil, Chiapas, a ring-stand, cylindrical vase with hollow rattle base having 5 circular vents and mat impression, is presented as a possible X Fine Orange specimen. The form is typical of X Fine Orange but the plano-relief technique, although deeper than customary, and the design motif are essentially that of Z Fine Orange. Two more examples with X Fine Orange forms and Z Fine Orange decorative techniques and style of design from the Postclassic (Qankyak phase), Tohil Plumbate horizon at Zaculeu (Woodbury and Trik 1953, Figs. 82, 83) are said to belong to Brainerd's Z type of Fine Orange. However, Z Fine Orange is a Late Classic and X Fine Orange a Postclassic type. Perhaps these exam-

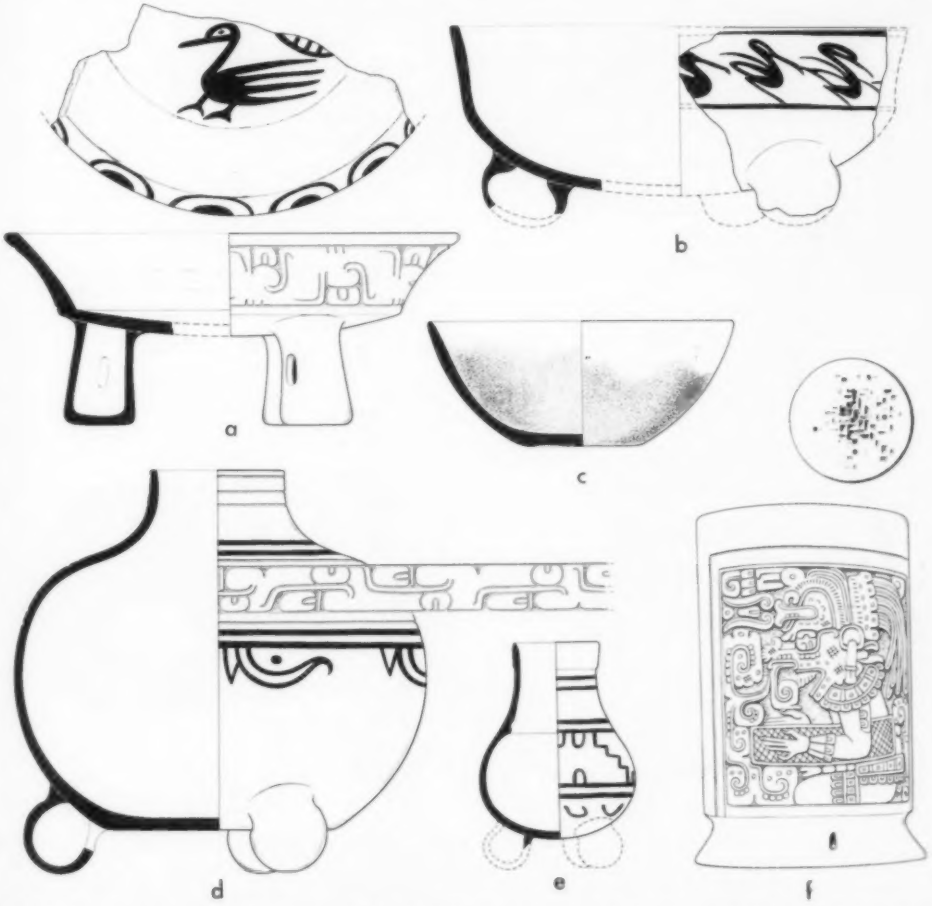

FIG. 4. X Fine Orange vessels. *a-e*, Chichén Itzá; *f*, Moxviquil. *c*, fire-clouded all over save for rim area; *f*, rattle base with mat-impressed bottom (courtesy of Frans Blom and C. W. Weiant). Height of *d*: 21.5 cm.

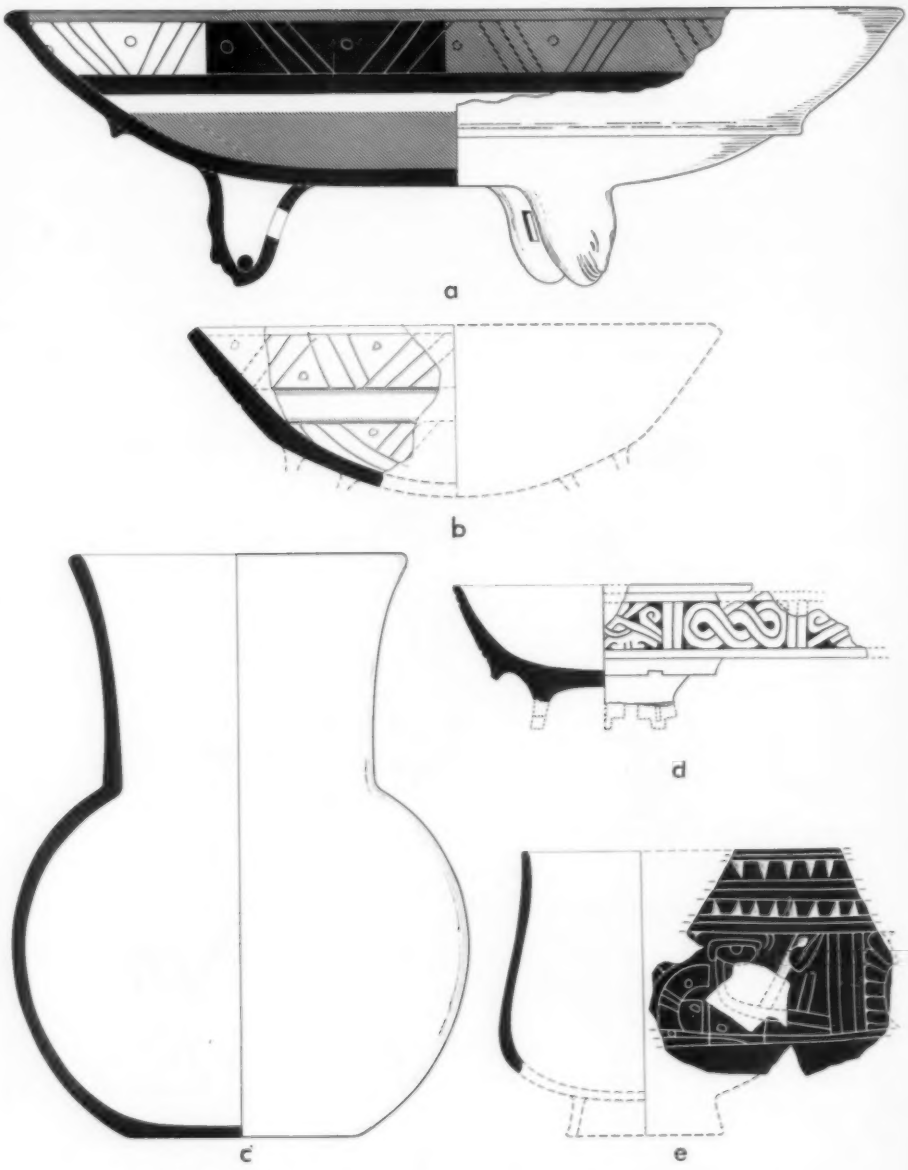

FIG. 5. V Fine Orange vessels. *a-c*, *e*, Mayapán; *d*, Atasta. Lip diameter of *a*: 42.2 cm.

ples all belong to an unidentified type of fine orange, transitional between Z and X types.

V Fine Orange. This type of fine orange is closely associated with the principal or major occupation of Mayapán. The real center of concentration, however, has been established in Tabasco by Berlin (1956) at such sites as El Coco, Tamulte, and Juarez, and in Campeche at Atasta. Ruz Lhuillier (1945) notes the following places in Campeche where V Fine Orange has been found: Aguacatal, Los Guarixes, Tichel, and Champotón. Sanders recognizes this type in Quintana Roo at Cancuén, Mulchí, and Tulum (Berlin 1953). Berlin (1956) assigns V Fine Orange to the early phase of the protohistoric Cintla horizon and U Fine Orange to the late phase. Thus V Fine Orange was flourishing from approximately 1200 to 1400.

The characteristic shapes of V Fine Orange are shallow tripods with an encircling ridge or flange (Fig. 5 *a*) which may be notched and with plain (solid conical, hollow cylindrical, hollow bulbous) or hollow effigy (moldmade human or animal heads) feet; the same shape of tripod without ridge or flange (Fig. 5 *b*); a similar form with flange and ring stand (Fig. 5 *d*); a tall-necked jar (Fig. 5 *c*); and a pedestal-based deep bowl (Fig. 5 *e*). The method of decoration includes incising, and gouging-and-incising; the design consists mostly of simple abstract patterns.

U Fine Orange. Berlin (1956) has identified U Fine Orange from the coastal Tabasco-Campeche region (Juarez, Tamulte, El Coco, Cintla, Madero, Atasta), and he places it in the last part of the protohistoric period, possibly 1400 to 1530.

Shape characteristicss provide the diagnostic traits for U Fine Orange: round-sided, deep or shallow tripods with lateral ridges, sometimes notched, and with solid thin slab feet (Fig. 6 *b*), usually stepped (Fig. 6 *c*); the same form without lateral ridge but with solid conical feet on the smaller vessels (Fig. 6 *e*), and hollow, cylindrical, flat-bottomed or tapering to rounded bottom on the others (Fig. 6 *a*); miniature vases with pedestal bases (Fig. 6 *g*); deep bowls (Fig. 6 *f*); ladle censers (Fig. 6 *d*); and human effigy censers of hourglass-shaped type with a standing human figure attached to the exterior (Fig. 6 *h*). It is significant that none of the deep or shallow tripods, miniature vases, and deep bowls carries any decoration, whereas all V Fine Orange shallow tripods are incised.

Figurines. Although figurines have not previously been mentioned in connection with fine orange, there are figurines of this ware. Berlin (1956: 125) refers to the majority of Jonuta figurines as being moldmade whistles or rattles of orange ware with little temper. I wonder if at least a few may not have been untempered and therefore probably fine orange, in this case of type Y. Since the figurines are definitely Classic Maya in style, they fit well into the Late Classic period. A very handsome, hollow, moldmade, fine orange, figurine head with a hat was found near the surface at Uaxactún (Smith 1936, Figs. 16, 17; hat was discovered after publication). From Jaina have come hundreds of figurines, at least a few of which on close inspection appear to be fine orange specimens. In fact, I believe that many of them are. These Jaina figurines, which are also found at Huaymil, are of 2 types. The older type is modeled and not of fine orange or even orange paste (Ruz Lhuillier 1945, Fig. XXXIV); the more recent type is moldmade (Ruz Lhuillier 1945, Fig. XXXV) of orange paste which is probably mostly of fine orange variety. The hollow moldmade type served as whistles or rattles and supposedly are of Z Fine Orange. The solid modeled specimens are beautifully made figures probably belonging to the Late Classic period.

Isla de Sacrificios. On Isla de Sacrificios several closely associated, highly distinctive, untempered wares, are found with Tohil Plumbate (Shepard 1948): X Fine Orange (Brainerd 1941, 1942, 1953), fine orange polychrome (Brainerd 1941), fine buff polychrome (Drucker 1943a), and Cerro Montoso Polychrome (Strebel 1885-89), or Isla de Sacrificios II (Medellín Zenil 1955). Drucker (1943b: 34), is probably referring to several of these when he writes about "Untempered Ware."

> [He] believes this [untempered] ware to be a manifestation of a ceramic type widely distributed both in time and space in the Veracruz area. On the one hand, it is represented by the Tres Zapotes Polychromes, and on the other, by a number of late Veracruz types, such as the wares designated Cerro Montoso, or "Totonac." It even seems likely that the well-known Fine Orange belongs to this same class. Not only is there correspondence in the type of paste (which indicates a technology distinct from that of other wares of the region), but, as well, certain shapes suggestive of that of classic Fine Orange occur in the Untempered ware, and the combination of incising and painting for decorative effect also occurs.

It seems clear that by classic Fine Orange Drucker means X Fine Orange.

Isla de Sacrificios was a ceremonial burial place and the repository of much of the best in pottery and other artifacts for close to 400 years. Some of the objects came from near by and others from more distant regions. The fine orange polychrome cannot at present be pinned down as to its center of manufacture. It is often found with X Fine Orange at such sites as Chichén Itzá and Huaymil, but in small amounts. At Isla de Sacrificios it is somewhat more frequent. The decoration does not conform to a single style; at least 2 styles are represented, one reflecting the Classic tradition, the other the Toltec style. On the other hand, the vessel shape is uniformly of the X Fine Orange variety. Many more examples of fine orange polychrome are essential and much more research is needed in this field before adequate answers to these problems can be expected. The one thing that stands out about Isla de Sacri-

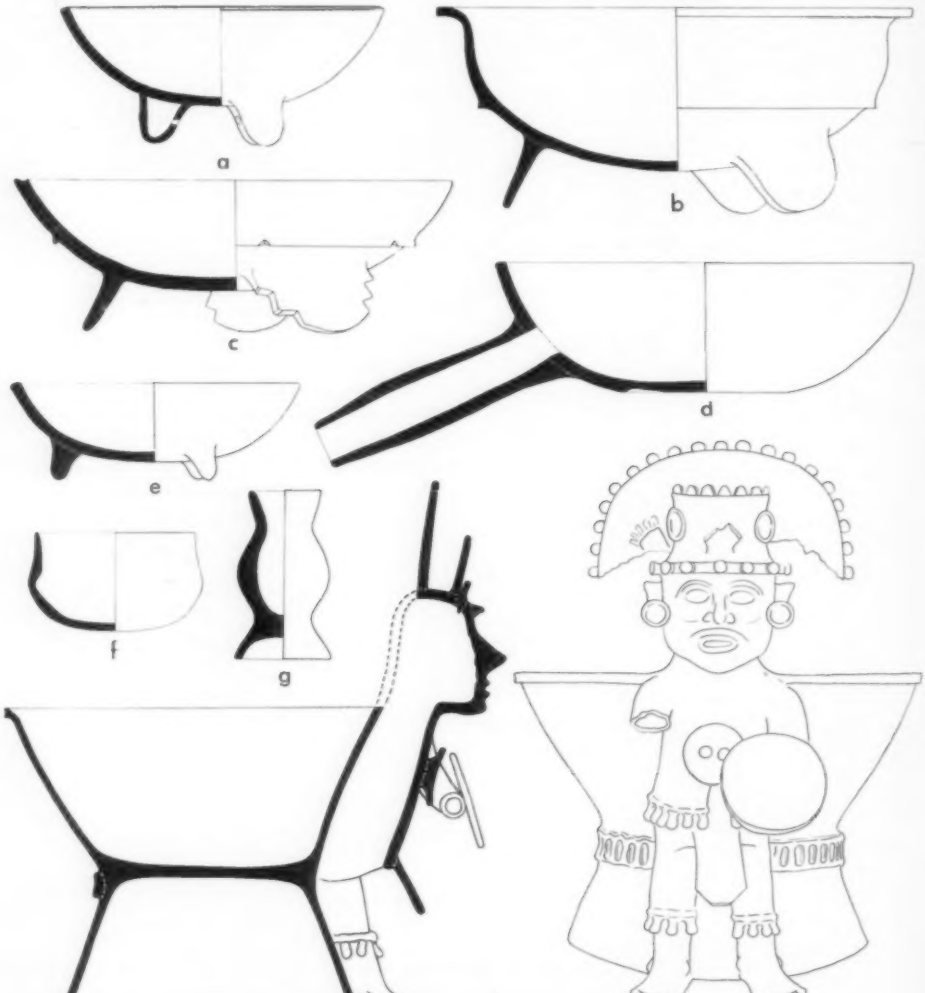

FIG. 6. U Fine Orange vessels from Tabasco and Campeche. *a, c, e, f,* Atasta; *b, d,* Juarez; *g, h,* Tamulte. Lip diameter of *b*: 26.1 cm.

ficios is that it harbored a variety of definite fine ware types and 3 distinctive fine polychromes which cannot be grouped as a single ware called Isla de Sacrificios Fine Polychrome. Medellín Zenil (1955) has clarified the situation considerably by separating the fine polychromes into the following: Anaranjada fina policromada (orange paste) which he couples with Anaranjada fina; Isla de Sacrificios I-III (cream paste), of which II is essentially what has often been referred to as Cerro Montoso ware; and some examples of Cerro de las Mesas Superior (buff paste) without temper may conform to what I have called fine buff polychrome.

Besides the various Isla de Sacrificios fine (untempered) wares listed above Medellín Zenil includes another which he calls "Metálica." This so-called ware seems to me to include various wares and types with only one thing in common — a vitrified surface finish. Most of the specimens illustrated by Medellín Zenil (1955) are of X Fine Orange form and design style, a few are of Plumbate style, and one has a form common to Panuco V, Cholulteca II, and Aztec I. I wonder if it is not possible that the vitrified appearance of these vessels is not the result of accident or experiment, in the latter case an effort by non-plumbate potters to achieve a plumbate effect, possibly by dipping and refiring.

Summary. A review of the foregoing makes it clear that at present only 5 types of fine orange (Z, Y, X, V, U in chronological sequence) can surely be recognized and that the only types which may be called Isla de Sacrificios Fine Orange are those polychromes which have been grouped under Medellín Zenil's Isla de Sacrificios I-III. Z Fine Orange and Y Fine Orange are Late Classic or Late Classic to early Postclassic Transitional types. X Fine Orange, although probably overlapping Z Fine Orange, is an early Postclassic variety current during Toltec times. V Fine Orange and U Fine Orange belong to the protohistoric period or Cintla horizon, the former type preceding the latter. The hollow moldmade type of figurine found in quantity on Isla de Jaina and Huaymil, often having what seems to be a fine orange quality of paste, was probably contemporaneous with Z Fine Orange. Thus, there is a series of fine orange types which have in common certain paste qualities, such as homogeneity, fineness, density, and lack of temper, but which vary considerably in shape, method of decoration, and style of design.

The occurrence in time of these types is far easier to judge than is their place of manufacture. In spite of the considerable knowledge acquired in Berlin's recent survey of Tabasco and the Laguna de Terminos region, it is difficult to identify places or areas of origin for the several fine orange types. A suggested list of centers of manufacture, based largely on relative frequency of occurrence in different areas and, to a lesser degree, on presumed stylistic affinities, is tentatively advanced: Z Fine Orange in the Jonuta-Tecolpan area; Y Fine Orange somewhere in the Petén of Guatemala or a region immediately adjacent to it; X Fine Orange along the coast of Campeche; V and U Fine Orange along the eastern part of the coast of Tabasco and the southwestern end of the coast of Campeche.

As for Isla de Sacrificios, besides the X Fine Orange and Tohil Plumbate art wares, there are 3 types of probably untempered and therefore fine polychromes. First, there is a fine orange polychrome often associated with X Fine Orange and conforming to that type in shape but not entirely in technique of decoration or style of design. The method of decoration involves the use of red, black, and white paint on an orange background. In design fine orange polychrome seems to have 2 major styles: bold abstract banding reminiscent of the Cerro Montoso patterns, and figure painting combining features of Maya Classic and Toltec art. Second, there is Isla de Sacrificios II described by Medellín Zenil. Third, a fine buff polychrome, an untempered buff paste ware which may contain vitric ash fragments native to the clay, was noted by Drucker at Cerro de las Mesas and Tres Zapotes. It has also been found at Mayapán and possibly on the Isla de Sacrificios. Since virtually no technological, or for that matter few analytical, studies of these 3 fine polychromes have been made, no adequate understanding of their various qualities and traits is available.

Furthermore, Medellín Zenil has suggested a metallic ware which I believe may be made up of various wares and types (including fine oranges) which have an iridescent and vitrified appearance. This appearance may have been achieved by dipping the vessel in a plumbate-like slip which would vitrify under reducing conditions.

Finally, there are a number of fine orange specimens difficult to place within the 5 known fine orange types. These probably belong to other so far unidentified fine orange types. It is also apparent that, although one may identify fine orange by its paste using color, quality, and lack of temper, no single criterion is sufficient to determine the type of fine orange. The importance of using all available criteria, form, decorative technique, and style of design, therefore, should not be underestimated.

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November, 1957

THE SCHAAKE VILLAGE SITE IN CENTRAL WASHINGTON

EARL H. SWANSON

THIS IS a preliminary report on a stratified site in the Vantage region of the Columbia Plateau (Fig. 1). The earliest occupation dates from 10,000 years or more ago, and the sequence terminates with historic aboriginal habitations. The geology has been treated elsewhere (Swanson 1956), and the Early Man remains are being prepared for publication. This report concerns the last inhabitants of the site, who lived at various times in a small village on the surface of the floodplain terrace (Fig. 2). In 1954,* 3 housepits (Nos. 12, 14, and 24) were excavated and 2 more trenched. Trench B went through what appeared to be one housepit (No. 4), revealing that there were, in fact, 2 houses (Fig. 8) and that the larger one apparently had an antechamber.

There were surface indications that different types of houses were present, presumably representing differences in time. Excavation verified that differences in type were indeed recognizable, some of which, at least, have temporal significance. It is now apparent that there were late prehistoric and historic (post 1811) occupations in this village.

Environment. This portion of the Columbia Plateau is presently semiarid in nature, with the flora transitional between the bunchgrass and sagebrush life zones of the region. The area of the bunchgrass appears to be decreasing as the result of heavy grazing, burning of brush cover in the tributary canyons, abortive attempts to destroy poison ivy by burning, which has destroyed only willows and cottonwoods. Within the memory of people living in this locale the grass cover was more extensive and considerably heavier, but has since become more patchy and discontinuous, with incursions of sagebrush onto the floodplain terrace.

In some of the backwater areas of the river there are beaver, and Canada geese still nest here. Deer are frequent, elk occasional visitors to the water's edge. Coyotes and jackrabbits appear to be rare; porcupines and cottontail rabbits frequent. Both rattlesnakes and bull snakes are common, though "seen" usually at night. A large and varied avifauna characterizes this stretch of the Columbia River gorge, with both upland birds and waterfowl attracting present day hunters. During 2 seasons in this area no clam beds were seen or heard of nearby, though fish are abundant in the river. Many of these fish are large carp; whitefish, steelhead, and salmon are caught locally.

Recorded rainfall at Quincy, some 15 miles north, is 8 inches per year, but this is supplemented by the water flowing into the Columbia River from its northern and western tributaries. This has resulted in a relatively high water table. The sequence obtained from other Vantage excavations suggests little climatic change has taken place regionally in the last few hundred years.

Procedure. Excavation was initiated by a trench from outside the supposed house depression, carried inside until the floor and edge

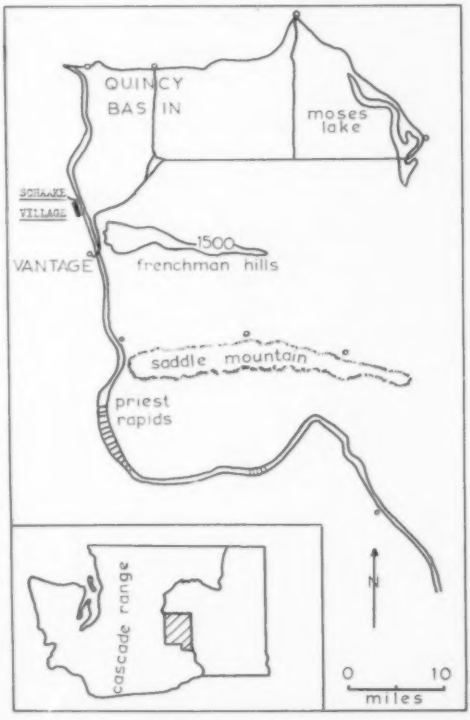

FIG. 1. Map of the Vantage region on the Columbia River in Central Washington.

* Research was supported by grants to Douglas Osborne from the Graduate College Research Committee of the University of Washington.

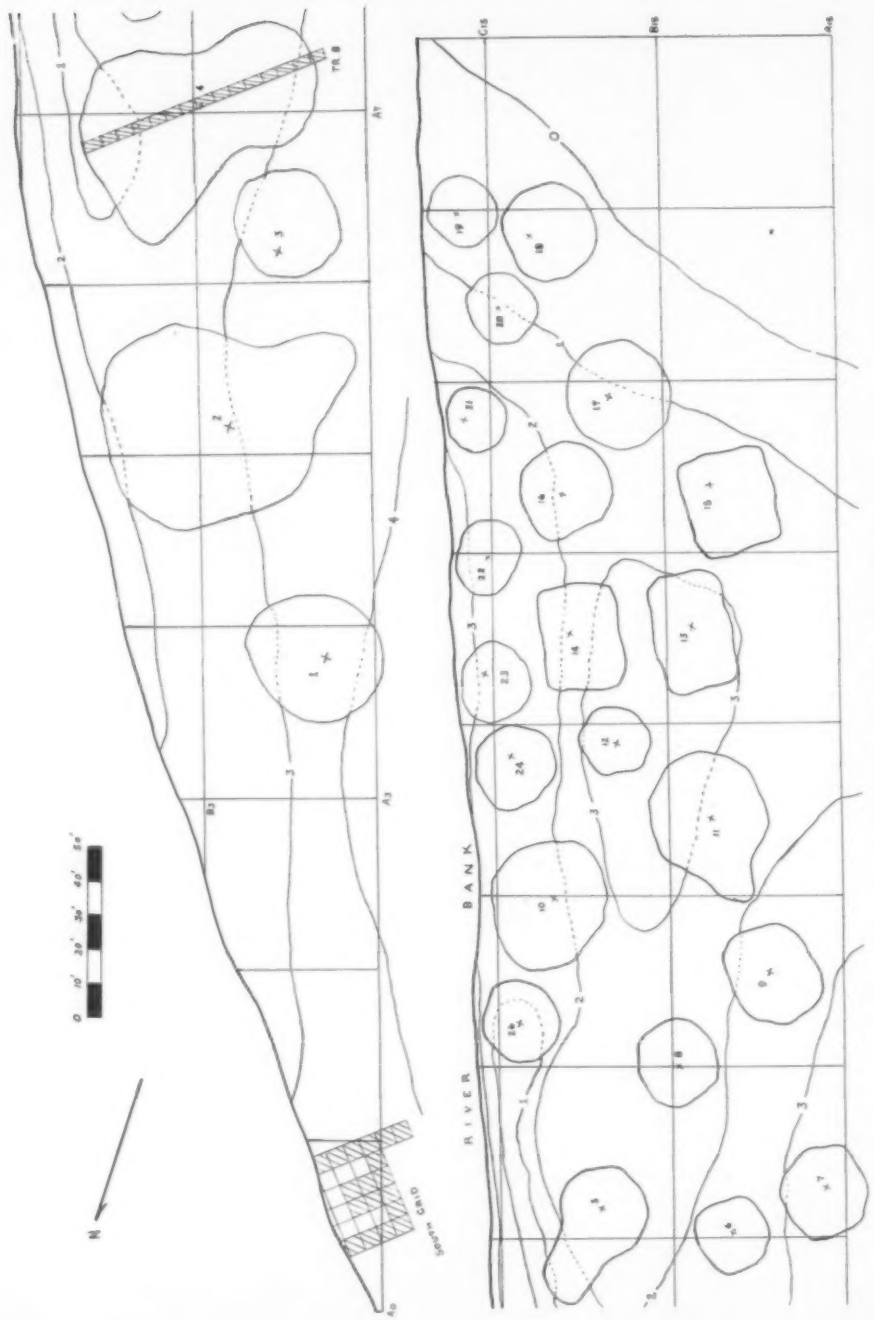

Fig. 2. Map of the Schaake Village.

could be identified at one point. Then the periphery of the house was defined by excavating around half of the circumference, or side, as the case may be. The rest of the house fill was removed as a unit. Floors were examined to see if more than one occupation had occurred, and horizontal sectioning was employed to locate features in the floor. Subfloor testing was conducted in House 12 and in the 2 houses exposed in Trench B. The 3 excavated houses were so close together that no attempt was made to examine the areas between them. Artifacts from one house may be incorporated in the room fill or windblown drift of an abandoned house, so that only those artifacts associated with a floor are considered properly associated with a house or its structural features.

House 14. Before excavation took place, mapping suggested a square depression, and this was verified by the digging. The floor at the center is 3 feet below the rim (Fig. 3). The east-west trench revealed the following sequence of deposits:

1. Surface sandgrass layer; about 2 inches thick; 1948 flood(?).
2. Light, thin, soil, 2-3 inches thick; a flood deposit covering dead grass; 1894 flood(?).
3. Sand layer with irregular humus deposits; very young soil beneath grass buried by 1894 flood; 4 inches thick.
4. Light sand layer, windblown, with dark tunnels marking old rodent burrows; 6 inches thick.
5. Dark, clayey silt; the A horizon of a fossil soil, fairly well developed; floor was cut into this.

Layers 3 and 4 were considerably, if irregularly, thicker in the center than at the rim where this section was measured.

The excavation established the presence of corners and the fact that toward the river and to the north the floor slopes gently up to the edge of the house. A bulge along the north wall of the excavation (Fig. 3) is the result of difficulty in defining the edge at that point. On the south side, the floor rises markedly in a convex fashion, extending 6 feet into the house (Fig. 3). This is probably a ramp entry made of packed earth. Along the east side there was a concentration of flakes and tools in association with the skeleton of a fish (salmon?), marked by hachure on the map. The only well defined tool was a flake end scraper, though some of the flakes appeared to have been used, suggesting that culinary tools are often impromptu productions. Tools were associated with both the hearth and the earth oven: in the case of the former, a Brandon-type core; with the latter, a blade, Brandon-type core, adz blade (Fig. 4 *a*), scraper, and ground-edge flake. Iron items were concentrated within the area marked on the map by a line composed of a dash, 2 dots and a dash. All but one of the iron objects were oxidized beyond recovery; the shape of 2 in the ground suggested knife blades. The one recoverable item is a horseshoe-shaped object (Fig. 5) with twisted iron wire on one side and 2 slightly raised knobs on the other which suggest a stand of some sort. Another tentative guess is that it served as a collar for a bolt attaching a wagon tongue to a box. Partly buried in the floor was a piece of iron lying on top of a block of petrified wood, possibly a strike-a-light set. Angular cobbles were found scattered throughout the zone marked by the line composed of a dash, 4 dots, and a dash. The distribution suggests that they were used as weights on a roof of perishable nature.

Bottle glass remnants were found on the floor of the house. These were sent to the Corning Museum of Glass through the courtesy of Sterling Lanier, a student on the expedition, and were identified by Paul N. Perrot. Additional historical notes were provided by Rollin Hadley. Perrot's note says these fragments "resemble

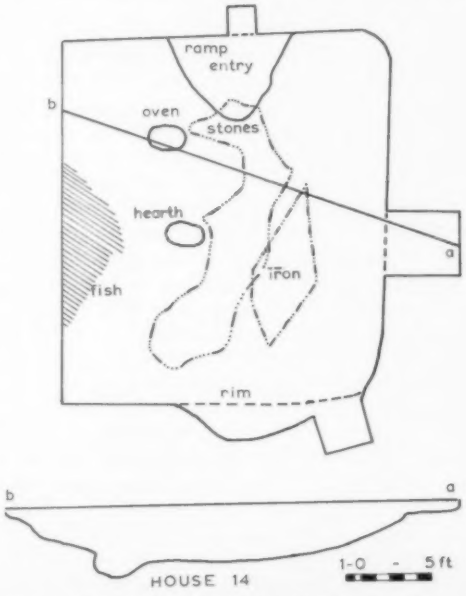

FIG. 3. Plan and section of House 14, Schaake Village.

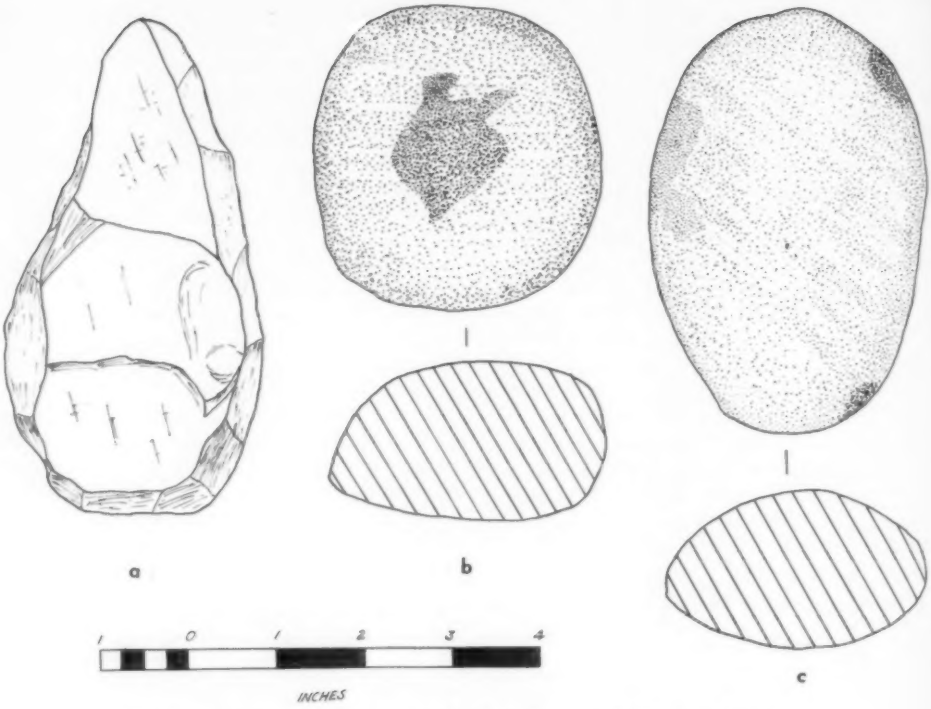

FIG. 4. Heavy tools from House 14, Schaake Village: *a*, adz blade of mica schist; *b*, *c*, manos (?) of fine-grained basalt.

those found not too long ago on the battle site of Fort Ticonderoga, Lake George, New York, together with other articles dating back to the American Revolution . . . Similar whiskey bottles, dark in color and with a bulbous body and slight kick-up in the base were made between the second half of the 17th and late 18th centuries. They were made in America and they are of English origin." Hadley adds that they were used by innkeepers for wines and whiskey, "particularly such things as port," and often had the seal of the inn imprinted on the side. Hadley's sketches of this type of bottle and of the 19th century type which followed are reproduced in Figure 6, *e*, *f*. Because the bottle is of American manufacture, is it quite possible that it was traded into this area between 1811 and 1813, when Fort Okanogan was under the control of the Astor Company (Brown 1914). Although the site is 100 miles to the south of the fort, it is situated on the route of travel between Fort Okanogan and the Astor Company headquarters at what is now Astoria, Oregon. It is unlikely that American products would have come into the region following establishment of trade control by the Northwest Company and later the Hudson's Bay Company. It is possible that this house was occupied between 1811 and 1813, at the very beginning of the historic era in the Columbia Plateau.

A total of 65 artifacts came from the floor, 25 from the room fill. This does not include 52 unworked, unused flakes which suggest tool production within the house during the winter months. Non-artifactual materials were few: 2 shells, 1 deer tooth, 2 split mammalian long bones, a phalange from a small mammal, and the fish skeleton already mentioned. The true burin, which was being used during historic times in the Plateau, may have been used on the piece of elk (?) antler found on the floor (Fig. 6 *p*). This broken piece of antler had a thin, tabular section cut from one side which may indicate the making of small antler needles by a splinter technique. Although blades comprise a small portion of the tools found (5.7%)

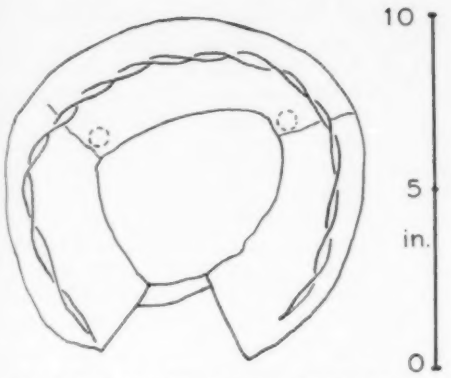

FIG. 5. Iron object from House 14, Schaake Village.

in the house, their presence is indicative of the persistence of a strong tradition developed during prehistoric times in the Plateau (Swanson 1956: 150).

Few of the tools are chronologically distinctive, apart from indicating continuity with the prehistoric period as represented in the Cayuse phases of the Vantage region (Swanson 1956: 151-2), of which there are 3, beginning perhaps about A.D. 1300 and lasting into the historic period. The basal-notched point (Fig. 6 *c*) is typical of the Cayuse III phase, and the crude pentagonal point (Fig. 6 *a*) is a poor version of earlier pentagonal specimens of the Cayuse phases. The adz blade (Fig. 4 *a*) continues the tradition of flake adzes in this area, but indicates a considerable decline in the skill evidenced in prehistoric production. The nose scraper (Table 1) is characteristic of the Cayuse III phase, but the tilted end scraper is a new trait (Fig. 6 *d*) which has yet to be defined in space and time. The steep scraper, so distinctive a feature of prehistoric occupation in the area (Swanson 1956: 63), has declined to nothing more than a thick flake end scraper, almost casually produced (Fig. 6 *g*). Although not of temporal value, the used polyhedral blade core (Fig. 6 *o*) is of technical interest as an example of blade production in the region.

The 2 handstones (Fig. 4 *b*, *c*) are of interest because they contrast strongly with the conventional pestles and mortars of the area. That they were used for grinding purposes seems clear from the striations, but no milling stones have been found on which they might have been used. There is no evidence of pounding, and in this respect they seem rather like the manos of the Southwest.

In summary, the distinctive artifacts from the house might easily be those of the last prehistoric phase in the Vantage region, Cayuse III, from which this house can be separated chronologically because of the presence of historic trade goods. There is a general decline in the skill with which these tools were produced which is so slight that only the presence of iron and glass permit recognition that this is a historic occupation. This situation is in accord with the continuity demonstrated for prehistoric times in the Vantage region of the Columbia Plateau (Swanson 1956: 183-5).

House 24. This circular, saucer-shaped house is 24 feet in diameter. The stratigraphy of the fill duplicates that of House 14. Few artifacts were found in this house, none of them distinctive enough to permit temporal distinction from other houses in this group. There are no historic trade goods, but what suggests that the house is prehistoric is its circular shape, which contrasts with the square outline of House 14, and fits that of the probable prehistoric houses examined at this site. No structural features could be located, although ash and some charcoal indicated a possible hearth in the center of the floor. An interesting feature was a piece of Ponderosa pine bark on the floor.

House 12. This shallow, circular, relatively small (17 feet 3 inches) house (Fig. 7) contained distinctive points which have not been previously associated with architecture. The stratigraphy duplicates that of House 14, with 2 modifications. The light, yellowish sand layer (No. 4) of House 14 is here a distinct gray, suggesting that the sand blew in on top of organic material which is indicated by the darkening of the sand at its base. It is impossible to determine whether the organic material was natural vegetation or decomposed roof fall. There are 2 occupations represented by 2 floor levels of packed clayey silt. Of these, the second or more recent was the most productive of artifacts. The first floor was 1.5 feet below the rim of the house. No entry into the house could be located. Postholes were found (Fig. 7), one of them indicating replacement of an upright. The circular outline of the postholes suggests that the posts stood vertically rather than at an angle. Although no indentations or holes could that the original members sloped toward the center of the pit, resting on rafters placed across the vertical uprights. Remains of ash and charcoal, indicating a hearth, were found 2 to 3 feet

from the rim to the southeast of the house center, so that an overhead entry is a possibility, though certainly no more than that.

Subfloor testing located a campsite of an earlier period. The area of this subfloor excavation is indicated on the plan view by a fine broken line. Later excavations in Trench B produced more artifacts from the same horizon. be located on the rim of the pit, it seems likely All of this material is discussed together below.

The first occupation produced 2 items of interest: a reworked, small, triangular point in fragmentary condition (Fig. 6 *b*) and a piece of graphite. The graphite is the first found in this area, but its function is uncertain, and its geological source is unknown. This mineral is not, however, found in the immediate vicinity, and is possibly a product of trade.

The second occupation of the house is notable for the points and for the superior adz blades. Only one of the points (Fig. 6 *m*) can be used for chronological purposes, and belongs either to the Cayuse II or III phase (post 1300 to about 1811). It resembles the point fragment from House 14 (Fig. 6 *c*), suggesting the later, Cayuse III phase. The 2 flake adzes are of

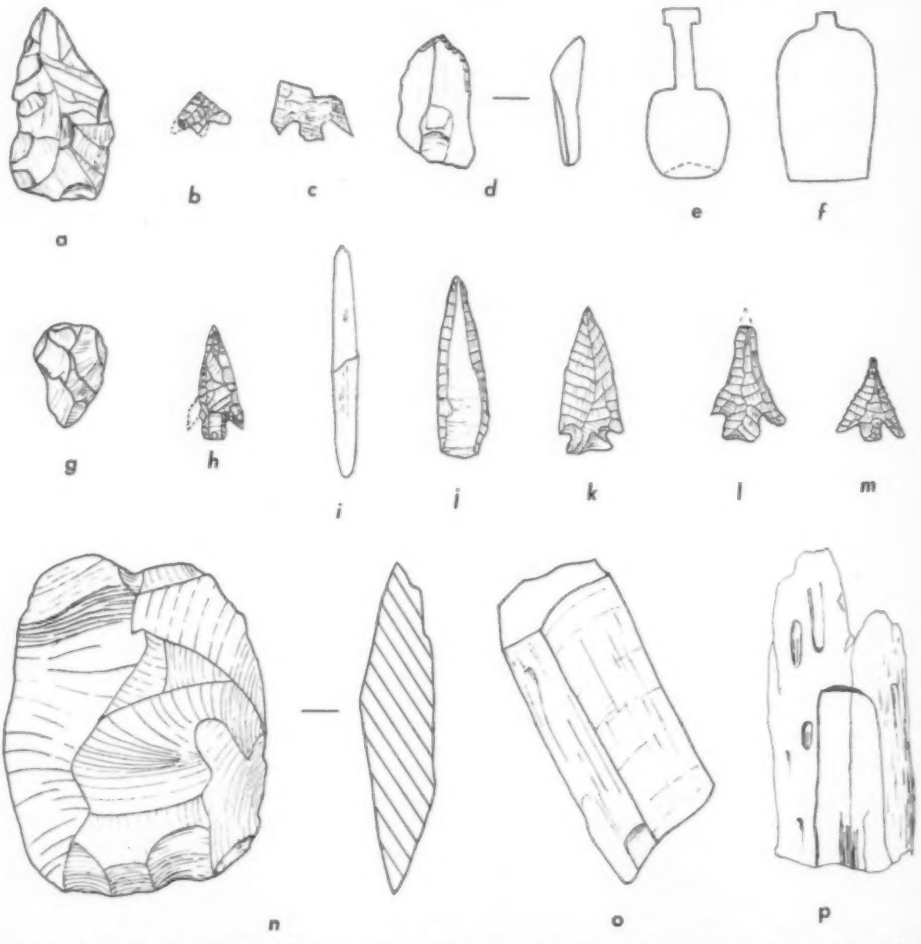

FIG. 6. Tools from the Schaake Village. *a*, *c-g*, *o*, *p*, from House 14; *b*, from first occupation, House 12; *j-n*, from second occupation, House 12; *h*, from House 4b; *i*, from campsite-workshop area beneath House 12. *a*, *c*, *j*, *k*, *o*, petrified wood; *g*, *h*, chert; *b*, carnelian agate; *d*, jasper; *l*, chalcedony; *m*, quartz; *n*, basalt.

basalt and mica schist, reflecting the diversity of materials associated with the production of adzes in the Lee site, which has been assigned to the Cayuse III phase (Swanson 1956: 109). The blades recovered (Fig. 6 *j*) exhibit workmanship superior to that of the blades in House 14, and, indeed, the general impression is one of greater skill in tool production at this time. In size and form, the 2 adz blades fit within the pattern defined for the Cayuse III phase. The other 2 points found in the second occupation will prove useful in expanding the typological variety of this phase and should be of help in its spatial definition. The circular shape of the house conforms to those already known from this time with the qualification that it is much smaller than any so far examined in this region of the Columbia Plateau.

Trench B. This long trench was cut through an apparently continuous depression which had been labeled House 4, and which appeared to be of exceptional size (Fig. 2). The trench soon revealed that there were 2 houses involved (Fig. 8), one with an antechamber or possible entry. It is likely that this represents an antechamber rather than an entry since some 58 items come from blocks 7 and 8. This information suggests that depressions 2, 5, and 11 also represent houses with antechambers (Fig. 2). There is a considerable difference in the size

TABLE 1. STONE TOOLS OTHER THAN PROJECTILE POINTS FROM THE SCHAAKE SITE.

Tool	*Type*	*Houses* (RF–Room fill; F–floor)								*Camp*	
		14		12			24	4			
		RF	F	RF	F_1	F_2	F	4a	4b	Camp	Totals
Cores	Brandon	2	2	3	0	0	0	8	4	1	20
	Bipolar	0	0	0	1	2	0	1	0	1	5
	Triangular	1	0	0	1	0	0	0	1	0	3
	Blade	0	3	0	0	0	0	11	3	19	36
Unworked Pebbles		2	3	0	3	0	1	3	3	0	15
Unworked, Unused Flakes		9	52	4	0	4	0	34	4	176	283
Scrapers	Small Core	0	2	0	0	0	0	0	0	0	2
	Thumbnail	0	2	0	0	0	0	0	0	1	3
	Triangular	1	6	0	0	2	1	1	0	0	11
	Nose	0	1	0	0	0	0	0	0	0	1
	Single-edge	5	8	0	0	0	1	3	6	0	23
	Double-edge	1	0	0	0	0	0	0	0	1	2
	End	0	5	0	0	0	1	1	0	0	7
	Long Flake	1	2	0	0	0	0	0	0	0	3
	Tilted	0	1	0	0	0	1	0	0	0	2
	Ground Edge	0	1	0	0	0	0	0	0	0	1
	Steep	0	0	0	0	0	0	1	0	0	1
	Keeled	0	0	0	0	0	0	0	0	1	1
Knives	Triangular	0	0	0	0	0	0	2	5	7	14
	Leaf	1	0	0	0	0	0	1	1	9	12
	Ovate	0	0	0	0	1	0	0	1	0	2
Blades		0	3	2	0	2	3	4	0	6	20
Burins	Ordinary	0	2	0	0	0	0	1	0	1	4
Adzes	Flake	0	1	0	0	2	0	0	0	0	3
Mauls		0	2	0	0	0	0	0	0	0	2
Pestles	Plain	1	1	0	0	0	0	1	0	0	3
Handstones		0	2	1	0	0	0	0	0	0	3
Mortars	Pebble	0	0	0	0	0	1	0	0	0	1
Totals		24	93	10	5	13	9	72	28	223	477

of the 2 houses exposed in this trench. The smaller has been numbered 4b, the larger 4a. The northward bulge of the depression associated with 4a suggests that there may be another antechamber comparing with the one visible in Blocks 7, 8, and 9 (Fig. 8). Comparison with depressions 5 and 11 indicates that House 4a is circular, as is House 4b. House 4a, however, has a diameter of some 40 feet, as against 22 or 23 feet for House 4b. The trench was continued beneath the floor, revealing the presence of artifacts in the A horizon of the fossil soil into which the floors of both houses were cut. The conditions are the same as those beneath House 12, and the finds from both places have been considered contemporary, so that they are treated here under one heading. It is quite possible that tools from the camp were picked up during the aboriginal excavations of house floors and then reused.

Two possible postholes, 2 inches in diameter, were found in Block 1, 2 feet in from the rim of House 4b. Both are circular and may be vertical uprights comparable to those in House 12. These extended 6 inches beneath the surface of the house floor. Ill-defined hearths were found to one side rather than in the center of both houses. A layer of decayed organic matter covered the floor in Blocks 11 and 12. No postholes or other structural features could be found in House 4a. Except for a fragment of bone needle from the floor of House 4b, bone in both houses consisted of splinters associated with the possible hearth areas.

House 4a has a greater floor depth than House 4b, being 4 feet below the rim as compared with 2 feet for the latter. The stratigraphy is comparable to that in House 14. The surface sand-grass layer of the 1948 flood is too thin to be represented on a section of the scale of Figure 8. In contrast with House 14, however, no distinction can be made within the houses between layers 2 and 3. The light sand layer here must be treated as one unit, where at House 14 it could be divided into 2 stratigraphic units because of the presence of grass, covered presumably by the 1894 flood. The yellow silt stratum in Houses 4a and 4b is eolian in origin, probably the same age as the light sand in Houses 14, 24, and 12. This cannot be of any great age since pieces of iron are present in the upper 3 to 6 inches. All pieces were oxidized except one that appears to be the bottom of a metal cylinder, perhaps a tin can.

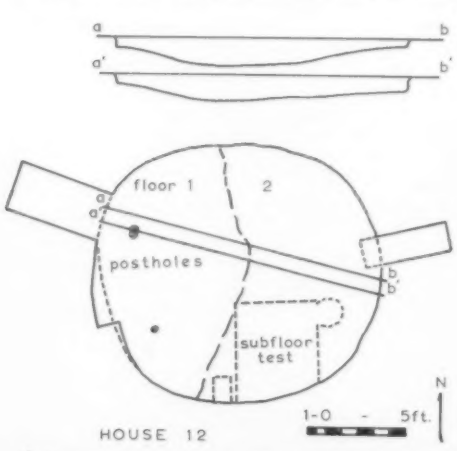

FIG. 7. Plan and sections of House 12, Schaake Village.

Distinctive artifacts are few in either house, apart from the point from House 4b (Fig. 6 *h*) which cannot be related to those in House 12. House 4a, however, has 11 blade cores, a feature that suggests it is earlier, comparable with the stratigraphically earlier campsite.

The Camp. The subfloor excavations in House 12 and in Trench B revealed artifacts in the black clayey silt of the A horizon of a fossil soil. This horizon is at least 24 inches thick, as shown by the section in Block 6 of Trench B (Fig. 8). It probably approximates this thickness beneath the whole village since the subfloor testing in House 12 was carried 18 inches into it without exposing the B horizon of the soil. This fossil soil is found close to the present surface where house floors were not cut into it. Where the effects of the 1894 and 1948 floods are visible they cover soils which were forming almost directly on top of this fossil soil. It is obvious that the house depressions broke flood currents and caused heavier deposition. Since the artifacts were found in the stratum before soil formation took place, the depth of the A horizon indicates an interval of time between the abandonment of the camp and the initial occupation of the village. The length of this interval is uncertain, since there are no time rates for soil formation in the area. Presumably, however, the development of the humus horizon required several centuries or more, and the conditions under which it developed must have been moister and have involved better vegetal cover than at the present time. In addition, the increased moisture prob-

ably produced intensified cutting on the part of the Columbia River, since deposition on the surface of the floodplain would have halted soil formation.

There is faunal evidence which suggests that the climate was more moderate even before the formation of what is now a fossil soil. When subfloor excavations were conducted in House 12, the skull of a mountain sheep was recovered. It had apparently been killed with a bone point (Fig. 6 *i*) which was driven into the forehead of the animal. The rest of the sheep had been eaten, the bones split and scattered. The find was accompanied by bits of charcoal and shell (freshwater mussel).

The bone point is typologically cruder and stratigraphically earlier than others found in the Vantage region and may serve as a horizon marker. It is particularly interesting that this was used for killing a land mammal, since such points are usually used with harpoons. This is not the only instance of such use, however; one was associated with a deer skeleton in Cedar Cave (Swanson 1956: 64-5) at a somewhat later time in prehistory.

The large number of unused flakes, the cores, and the fact that all but a very few tools are broken make it likely that this campsite was a workshop. The half dozen unbroken tools were found with the mountain sheep.

Discussion. This site permits tentative definition of a sequence of house types in the Vantage region of the Plateau. An archaeological chronology has been established for this region of the Columbia Plateau and should be available soon in a monograph based on Swanson (1956). It is briefly summarized here. Occupation of the Vantage region probably begins, at the latest, with the Anathermal and continues with changes into the historic period (post 1811). Two groups of phases have been established for the time span following the Altithermal: Frenchman Spring I-III and Cayuse I-III. Cayuse III ends in 1811, though it is certainly not always possible to recognize this upper end of the prehistoric sequence. It is possible to suggest on geological grounds that Cayuse I starts around A.D. 1300, though the geology itself is highly tentative. Frenchman Springs I begins around 1500 B.C. It is not possible, however, to do more than suggest rough temporal ranges for any phase, and it is not intended that the time spans of 1500 B.C. to A.D. 1300 and 1300 to 1811 should be divided equally among the phases. The principal difference between the 2 series is that the Cayuse phases clearly foreshadow the historic aboriginal pattern in the Plateau. In particular, there are differences in tools, ecology, and economy.

In the Frenchman Springs phases, blades and burins are outstanding features of the tool complex, and a contracting stemmed point is typical. Houses are situated in tributary valleys. Mussels were important in winter villages, and mountain sheep were hunted. A circular house was used in Frenchman Springs I and possibly also in Frenchman Springs II. A long, narrow house (mat lodge) was introduced during Frenchman Springs III. In the Cayuse phases, blades and burins decline sharply. Adzes were made in a variety of materials and on increasingly thinner flakes (Frenchman Springs adzes are principally core tools). Instead of single houses situated in tributaries, villages are found on the main Columbia River floodplain and are marked by an absence of mussels, hunting of deer, and an emphasis on fishing.

This chronology is based mainly on cultural sequences from caves which could be correlated geologically and archaeologically. In the main, the archaeological sequences are defined in terms of changes in cordage. These cave sites provide a fair typological series which can be extended to open sites where the geological evidence is unclear and perishables are lacking. One of the problems that developed in working

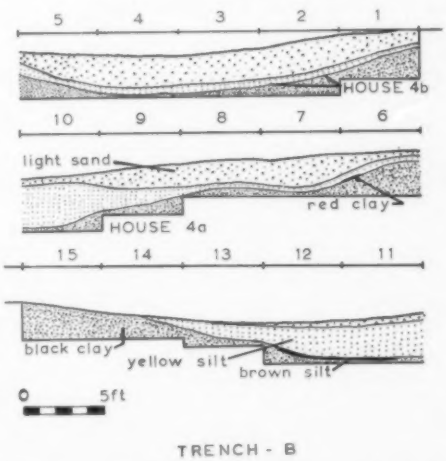

FIG. 8. Profile of Trench B, showing Houses 4a and 4b in section, Schaake Village.

out the chronology is the virtual absence of evidence for the Cayuse I phase. There is a considerable cultural gap in Cedar Cave and it is only partially filled by data from the Hole-in-the-Wall. As in most Plateau sites few artifacts were recovered from these sites. What few there were suggest that Cayuse I is a mixture of the characters distinguishing Cayuse II and Frenchman Springs III. This mixture is reflected in the cordage, but I have been uneasy about the establishment of this phase. Another problem is that the Frenchman Springs phases extend over a great range of time with distinctions enhanced by clearcut stratigraphic separations. Fortunately, some detailed evidence on these changes within the Frenchman Springs phases is provided by the excavations conducted by Claude Warren for the University of Washington at the Wenas site in the Yakima Valley to the south of Vantage.

The presence of 3 apparently distinct house types at the Schaake village is important. The square floor plan can definitely be associated with the historic period, and may possibly have been used between 1811 and 1813, as already suggested. The close similarity of certain artifacts to those of the Cayuse III phase tends to support an early historic date. Ray (1939: 135) regards this type of house as a local development out of the round earth lodge. House 12 may belong on typological grounds to the Cayuse 3 phase. The saucer-shaped depressions of Houses 24 and 4b resemble the House 12 type. The circular houses are roughly aligned in 2 rows (Fig. 2) and there is a third, abbreviated row further in from the river bank. Although neither Houses 24 nor 4b can be related through the tools to House 12, it seems likely that the 18 circular houses are approximately contemporaneous. The point from House 4b (Fig. 6) may therefore be tentatively added to the Cayuse III complex as another distinctive tool. Further, the fact that the circular houses are most common in the village correlates with the fact that in the caves and other sites which are discussed in the 1956 report, occupation apparently was heaviest during the Cayuse II and III phases.

The antechambered houses, such as House 4a, are something of an enigma. On stratigraphic grounds, House 4a cannot be demonstrated to be any earlier than Houses 12, 24, and 4b. The only clue lies in the 11 blade cores in this structure. This recalls the 19 found in the campsite-workshop which, on geological grounds, should belong to the Frenchman Springs phases. Since blades are a distinctive feature of the Frenchman Springs series, House 4a may be earlier than the other types of houses found at the Schaake village. The hypothesis is set forth that antechambered houses belong to the Cayuse I phase. Unfortunately, this puts the Cayuse I phase in no clearer typological situation than it has been so far, for the absence of complete and distinctive tools prevents close comparison with other sites in the area.

If the antechambered houses are indeed Cayuse I in age, then the sequence of house types illustrated in Figure 9 seems reasonable. There is a general lack of structural features. It is worth noting that the saucer-shaped house floors have poorly defined hearths to one side in Houses 4b and 12, but a possible central one in House 24. The ramp entry in the historic house is unique in the Plateau to date, and the earth oven is less than half the size of one from the Frenchman Springs III phase in Cedar Cave. It is possible that a decline in the size of earth ovens is an aspect of Plateau prehistory, for the one in Cedar Cave was used for fish and mammals, while the known historic ovens have been used principally for roots (Ray 1932: 106; Collier, Hudson, and Ford 1942: 38). This decline may represent a shift in economic emphasis, though very large ovens were apparently used on occasion in recent history (Collier, Hudson, and Ford 1942: 38). The mat lodge is a drastic change from the circular houses which precede and follow it in this area, though Ray (1939: 137-40) gives a Plateau-wide distribution in historic times. The fact remains that, archaeologically, only one mat lodge has been definitely identified in the Vantage region and is certainly separated from the historic period by a time in which circular lodges were built.

The campsite below the village is probably assignable to Frenchman Springs III on geological grounds. There are 2 important problems here. The first concerns the gap in time represented by the interval required for soil formation subsequent to the deposition of the campsite artifacts but prior to the occupation of the village. This gap compares with that in Cedar Cave where Cayuse II is separated from Frenchman Springs III occupation by a bed of compact mountain sheep dung 3 feet thick. Layers could be distinguished, indicating that some compression has taken place. Again, one suspects several

centuries are missing from the cultural record. If the situation at Schaake village is comparable with that in Cedar Cave, then the antechambered houses may be Cayuse II rather than Cayuse I. Secondly, the question of climate must be considered. If the soil formation indicates a moister and perhaps cooler climate than now, why should the area have been, apparently, without occupation? Again, the continuous deposit of mountain sheep dung in Cedar Cave suggests uninterrupted occupation of the area by those animals. Yet above and beneath this one bed are alternating deposits of artifacts and sheep dung, the latter having little thickness and no compactness, suggesting that man hunted these animals with some regularity. Presumably the vegetal cover was better than now, so that sheep grazed on the floodplain. Does the absence of sites on the floodplain involve a population shift? Is this in turn related to the change in emphasis from hunting of larger game to fishing? By the time of the Cayuse II phase, evidence of mountain sheep on the floodplain disappears. It seems likely that in the centuries before and after 1300 a major cultural reorientation took place, but its point of origin is most uncertain. The presence of maize in the area (Swanson 1956), manos (in House 14), and the advent of pottery in the Plateau (Osborne 1957) hints at influence from the Greater Southwest (Kirchhoff 1954) during this time. Perhaps the antechambered house is also a reflection of such influence. Obviously, much more needs to be known.

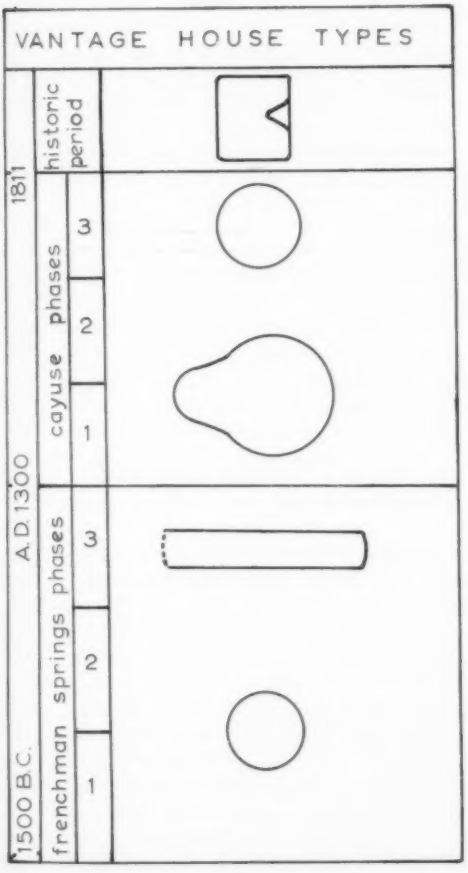

FIG. 9. Proposed sequence of house types in the Vantage region of the Columbia Plateau.

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IDAHO STATE COLLEGE MUSEUM
Pocatello, Idaho
January, 1958

ANCIENT MESOAMERICAN MORTARS, PLASTERS, AND STUCCOS: THE COMPOSITION AND ORIGIN OF *SASCAB*

EDWIN R. LITTMANN

THE USE of *sascab* as a substitute for sand in the preparation of ancient (and modern) mortars and plasters in Yucatán has been noted by many writers including Landa (Tozzer 1941: 171, 176), Morris, Charlot, and Morris (1931, Vol. 1: 220-4), E. H. Thompson (1887), and Villa R. (1934). R. H. Thompson (1958) details the use of *sascab* as temper for making pottery. *Sascab* is described by Villa R. (1934) as a soft limestone conglomerate; it has also been spoken of as an unconsolidated limestone. *Sascab* is a white to reddish, compacted powder, frequently containing rounded boulders or stones, and found in pockets in the limestone of Yucatán and possibly other areas with a similar geography. The term *sascab* is most frequently associated with Yucatán, though it is also used at Palenque in Chiapas to designate a whitish, powdery earth. At this location, however, the *sascab* is found as a *lomita*, or small hill, near the base of the escarpment upon which the presently excavated buildings are located. For the purposes of this discussion, *sascab* will be considered as the powder found in pockets in the surrounding limestone.

The existence of *sascab* as a powder completely surrounded by hard limestone is an unusual phenomenon and suggested a study of its composition and possible origin.

The contrasting physical forms of *sascab* and its surrounding limestone may be accounted for by one of the following conditions:

1. Deposition in a cavity in the already formed but submerged limestone and therefore protected from the hydrostatic pressure or other conditions required to effect consolidation. Any *sascab* deposited under these conditions would probably have been in chemical equilibrium with its environment, and, if formed from marine skeletons, would have a chemical composition characteristic of such skeletons. It would also be necessary for the cavity to have been sealed off from the surrounding water if the *sascab* was to be protected against its environment.

2. Deposition in a cavity in the already formed limestone *after* the stone had emerged from the sea. To be deposited under these conditions, *sascab* must have been transported to its final location by either surface or subterranean streams and would, therefore, not be a primary accumulation of marine skeletons.

The presence of rounded boulders or stones in the *sascab* strongly suggests a uniform, abrasive action on the original stone fragment, an action such as tumbling in a silt-laden stream. This, in turn, suggests that the *sascab* was waterborne to the point of deposition.

To throw further light on this subject, samples of *sascab* from several locations, stones found in the *sascab*, and limestone from the immediate and near-by areas were analyzed by the methods described in an earlier publication (Littmann 1957). Certain of these analyses were also compared with those of plasters of known marine origin (shell) on the theory that the latter would be representative of newly deposited layers of marine skeletons. A similarity of the composition of *sascab* with the plasters of marine origin and the presence of marine skeletons would be compelling evidence of the marine derivation of the *sascab*. The analyses showed no such similarity, and it may be concluded, therefore, that *sascab* is not of primary marine origin but rather a product of the natural weathering of limestone.

ON-SITE OBSERVATIONS AND SAMPLING

Uxmal. The red *sascab* and the stone found with it were dug from a pit in the limestone at a point about ½ mile from the site. The yellow and white samples were taken from piles at the site and were being used in the preparation of mortar for restoration work then in progress. The limestone was a fragment picked at random from the ground at the Monjas. All 3 *sascab* samples were definitely crystalline when viewed under the microscope. The crystals were essentially white and clear to translucent. The colors were due to associated particles, probably iron oxide. No marine skeletons were observed.

Sayil. The *sascab* is classified as red and was dug from a pit on the south side of the palace. The limestone was a fragment found on the ground near the *sascab* and showed little sign of weathering. The crystalline character of the *sascab* was essentially the same as that obtained at Uxmal. No marine skeletons were observed.

Chichén Itzá. The *sascab* is classified as yellow and was taken from a pile being used by local workmen for construction work not associated with the ruins. It was mixed with a large quantity of small stones, most of which

were rounded or showed rounded or worn edges. Before analysis the stones and *sascab* were separated by screening through ordinary window screen. The crystalline structure of the *sascab* was again similar to the 2 previous samples. No marine skeletons were observed.

Palenque. This *sascab*, as noted previously, was not found in a pit but was part of a hill at the bottom of the escarpment, more or less directly below the North Group of ruins and at the side of a dry stream bed. The sample was taken from an exposed face of the bed and when dry was a soft though crystalline powder. The sample of limestone was taken from a pile of rubble on the east side of the pyramid of the Temple of the Inscriptions and showed no weathering.

Jaina. This sample was collected by G. F. Ekholm during a visit to the island of Jaina in 1957 and is classified as white. It was taken from the side of a pit. No marine skeletons were observed.

Mayapán. The sample of limestone was found in the mortar used on the interior of the arch located about 1 km. east of the main pyramid.

Cenote de Xlacá (Dzibilchaltún). The limestone was a fragment picked from the ground and showed little or no weathering.

Las Flores (Tampico). The sample of plaster was supplied by G. F. Ekholm.

Comalcalco. This plaster is Sample 15 described in an earlier paper (Littmann 1957) and was chosen on the basis of a similar acid-insoluble content to the Las Flores plaster.

EXPERIMENTAL RESULTS AND CONCLUSIONS

To obtain further information on the composition and possible origin of *sascab*, several samples of the earth and the associated and geographically related limestones were analyzed and the analyses compared with those of plasters prepared from lime of unquestioned marine origin.

The interpretation of these analyses must take into account the composition of the limestone associated with the *sascab* and the relation of the composition of the *sascab* to the limestone. On this basis the *sascab* samples associated with a calcite are considered separately from those associated with a dolomite or a dolomitic limestone. In the first category are the *sascab* and limestone samples obtained at Sayil, Chichén Itzá, Jaina, Mayapán, and Cenote de Xlacá, whereas those in the second category were collected at Uxmal and Palenque.

Calcite is essentially calcium carbonate containing only small amounts of magnesium, or in which the calcium/magnesium ratio is high. Dolomite or a dolomitic limestone has a very much lower ratio which may closely approach one, in which case equimolecular quantities of the 2 carbonates are present. It will be seen from Table 1 that the calcium/magnesium ratios of the limestones from Sayil, Chichén Itzá, Mayapán, and Cenote de Xlacá vary from 12.1 to 44.0, and if the stones found in the *sascab* at Chichén Itzá are included, the upper value is extended to 61.2. These values indicate the limestones to be essentially calcite. The limestones from Uxmal and Palenque show calcium/magnesium ratios from 0.98 to 1.03, including the stone found in the *sascab* from Uxmal. The ratios for the calcite-associated *sascab* samples indicate that they too should be classified as calcites. Whereas the dolomite-associated *sascab* from Palenque would also be classified as dolomite, the *sascab* from Uxmal may be classed as either calcite or, in one case, a dolomitic limestone. Since for the purpose of this study it is essential to examine the data pertaining to *sascab* when associated with limestone, no further comment will be made regarding the Jaina *sascab* or the Mayapán or Cenote de Xlacá limestone except to say that they appear to be little different from the other materials.

A closer examination of the data in Table 1 shows that the compositions of the calcite-associated *sascab* are not greatly different from those of the associated limestone, whereas there is a marked difference in the case of the Uxmal materials. The latter also differ greatly in composition from the marine-derived, shell plasters. The *sascab* from Palenque, while dolomite-associated, is very similar to the surrounding limestone in contrast with the situation obtaining at Uxmal, but also unlike the shell plasters. To account for the existence of *sascab* in a powder or unconsolidated form, and possibly to explain its origin, all these differences must be reconciled. In the case of the materials obtained at Uxmal, the significance of the analyses lies in the calcium/magnesium ratios which show marked differences between the shell plasters and white *sascab* when compared with the other materials. Marine shells and probably the

skeletons of other marine animals are characterized by low magnesium contents and calcium/magnesium ratios higher than 15 to 20, whereas many limestones have ratios ranging from 4:1 to 1:1 which are characteristic of dolomitic limestone and dolomite respectively. Such limestones correspond with the formulae $4CaCO_3.MgCO_3$ and $CaCO_3.MgCO_3$. If the stone and the *sascab* were originally of marine origin, then their high magnesium content can be explained only by some natural process which occurred subsequent to their deposition. If they were not of marine origin, they would, in all probability, be simply a deposit of either powdered or fragmentary limestone. The chemical analyses tend to preclude the latter situation even though microscopic examination of the *sascab* showed no marine skeletons, rather only crystalline material.

The only natural process affecting this *sascab* is probably a change in composition resulting from contact with surface or subterranean water which was not only instrumental in its original deposition but which also continued to percolate through the mass for an appreciable time afterward. If it is *assumed* that *sascab* was originally of marine origin with a composition similar to shell, its magnesium enrichment may be readily explained on the basis of contact with water flowing through or over limestone since such water would preferentially leach out magnesium carbonate which is approximately 8 times as soluble as calcium carbonate. The exact manner or cause of its reprecipitation cannot be stated, though the normal alkalinity observed in wet calcium carbonate would tend to precipitate a complex hydroxy magnesium carbonate. The finely divided state of *sascab* would tend to rapidly accomplish this result because of the large surface area of the minute particles constituting the mass. If the assumptions regarding magnesium enrichment are valid, the several samples analyzed should show a linear relationship between the calcium and magnesium contents. The analyses for these elements were therefore recalculated to an acid-

TABLE 1. ANALYSES OF *sascab* SAMPLES AND RELATED STONES.

Site Sample	Insoluble %	Ca %	Mg %	Acid-Insol. Basis Ca %	Acid-Insol. Basis Mg %	Ca/Mg Molar Ratio
Uxmal						
sascab (white)	4.2	36.7	0.93	38.4	0.97	23.8
sascab (red)	9.1	31.6	2.4	34.8	2.6	7.9
sascab (yellow)	3.8	28.6	6.5	29.7	6.8	2.6
Stone in *sascab*	0.05	21.6	13.1	21.8	13.1	0.99
Limestone	0.88	21.6	12.5	22.6	13.1	1.03
Palenque						
sascab	1.2	21.1	12.9	21.4	13.1	0.97
Limestone	1.9	20.9	12.7	21.3	13.1	0.98
Sayil						
sascab (red)	6.7	36.6	0.59	39.2	0.63	37.7
Limestone	0.23	38.6	0.52	38.7	0.53	44.0
Chichén Itzá						
sascab	24.2	26.9	0.48	35.5	0.63	34.1
Stone in *sascab*	0.08	39.3	0.39	39.3	0.39	61.2
Jaina						
sascab	0.13	35.2	1.3	35.2	1.3	16.2
Mayapán						
Limestone	1.9	35.7	1.7	36.4	1.8	12.1
Cenote de Xlacá						
Limestone	Nil	39.0	0.70	39.0	0.70	30.4
Las Flores (Tampico)						
Plaster	4.9	36.4	0.30	38.3	0.32	72.8
Comalcalco						
Plaster	4.7	35.5	0.38	37.2	0.40	56.0

insoluble-free basis as shown in Table 1. Their linear relation is shown in Figure 1. The principle of magnesium enrichment is, however, not necessarily indicative of the marine origin of *sascab*, nor proof of it, as will be seen from the following discussion.

On the basis of the analyses given in Table 1, there seems little doubt that the stone or boulder found in the *sascab* is a limestone fragment, very similar in composition to the limestone of the general area. Its smoothly rounded shape appears to leave little question but that it was water-borne to its location in the *sascab*, probably by an underground stream similar to those present in Yucatán today. The deposition of the *sascab* can be accounted for in the same manner, since any constriction in the water course would probably be closed by the deposition of finely divided, siltlike material carried by the stream. This process could continue until the path of the water was completely blocked and it found an outlet in some other direction.

While *sascab* has been previously assumed to be a primary marine skeletal deposit, it is difficult to reconcile such an origin with its location in the surrounding limestone in the absence of evidence of volcanic or similar phenomena that would suddenly lift the rock mass above the floor of the sea and permit the washing of the marine skeletons into a pocket in the limestone. It is also difficult to associate a limestone fragment, as at Uxmal, weighing several kilograms with finely divided marine skeletons, in an essentially surface deposit. A more probable explanation of the primary source of the *sascab* is limestone itself. The relatively heavy rainfall in Yucatán would probably extract the magnesium carbonate from the dolomitic limestone, leaving a soft, pitted surface easily disintegrated by weathering into a silt which could be carried away in the runoff of the rain.

On the basis of this reasoning, it appears that the Uxmal *sascab* is a form of weathered limestone deposited in a cavity in preformed limestone by surface or subterranean water. The relative ages of the white, red, and yellow Uxmal *sascab* samples studied, as interpreted from their calcium/magnesium ratios (Fig. 1), increase from white to yellow.

The calcite-associated *sascab* samples from Sayil and Chichén Itzá show, in each case, slightly lower ratios than do the corresponding limestones, a situation directly reversed from that at Uxmal. If the formation of these *sascab* deposits was brought about by disintegration of the surrounding stone by weathering, a satisfactory explanation for their magnesium enrichment must be provided. It is believed that such an explanation resides in the phenomenon of magnesium enrichment through deposition of magnesium carbonate from magnesium-rich water passing through the deposited calcite or weathered limestone. Such a process has been demonstrated in the laboratory in the following experiment. A glass tube about 8 mm. in internal diameter and constricted at the bottom was fitted with a closely fitting gauze plug at the constriction. On top of this was placed 1.5 g. (30 mm.) of dry, powdered Jaina *sascab*. This was followed by a second gauze plug and 3.0 g. (6.0 mm.) of the same *sascab* and another plug. The top of the tube was then attached to a pear-shaped reservoir and distilled water allowed to percolate through the column. Percolation is very slow and after 5 days 25.5 ml. of percolate was collected. The water in the upper part of the column was poured out and the tube contents removed by pushing against the lower plug with a stiff wire. The upper and lower portions of *sascab* were dried in an oven at 110° to 120°C. and then analyzed. The per-

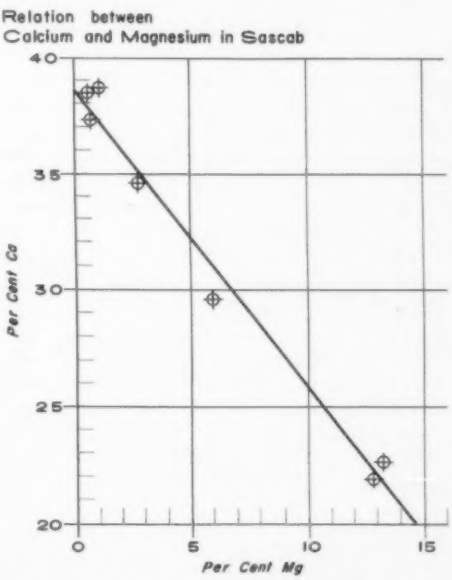

FIG. 1. Relation between calcium and magnesium in *sascab*.

colate was diluted to 100 ml. and also analyzed for calcium and magnesium. The results of these analyses are shown below in Table 2.

TABLE 2. MAGNESIUM ENRICHMENT OF *sascab* BY WATER TRANSFER OF MAGNESIUM CARBONATE.

Sample	*Ca. %*	*Mg. %*	*Ca./Mg. Ratio*
Upper Section	35.5	0.85	26.1
Lower Section	36.1	1.2	18.0
Percolate (Solution)	0.0058	0.0088	0.66

It is quite evident that enrichment of the lower segment of the *sascab* occurred by transfer of magnesium carbonate from the upper. This selective extraction of magnesium carbonate is further confirmed by the very low ratio found in the percolate.

The reconciliation of the magnesium enrichment in the case of calcite-associated *sascab* with its depletion in the case of its association with dolomite cannot be made on the basis of direct experimentation. There is, however, a plausible explanation. If the amount of water falling on the limestone surrounding the *sascab* and instrumental in its formation is relatively small and remains in contact with it for an appreciable time, it would tend to be saturated with magnesium and calcium carbonates in equilibrium proportions. This condition parallels the experiment described above and is conducive to the magnesium enrichment of a deposit of *sascab* as the water filters through it. If, however, the volume of water was large and the time of contact with the limestone short, its magnesium and calcium carbonate content would be below saturation and such water passing through a bed of *sascab* would further extract magnesium carbonate and give rise to the phenomenon of depletion as was observed in the cases of the Uxmal material. This reasoning appears to be borne out by the relationship between the *sascab* and limestone from Palenque. In this case, the *sascab* deposit is the lower portion of a steep hill from which water would drain rapidly and over which vegetation would quickly grow. The opportunity for extensive solution and redeposition of magnesium carbonate is therefore greatly minimized and any *sascab* formed by erosion should have essentially the same proportions of magnesium and calcium carbonates as exist in the stone from which it originated. The analyses of the Palenque materials show this to be the case.

In view of the evidence presented, it is highly probable that *sascab*, generally, is the product of weathering or erosion of the associated limestone and not of marine origin, and that the accumulation and composition of *sascab* can be accounted for by known natural phenomena.

Acknowledgement. The author wishes to express his sincere thanks to Alberto Ruz Lhuillier for his assistance in securing the samples of *sascab* and the stone and for his advice and information concerning these materials.

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WESTFIELD, NEW JERSEY
February, 1958

FACTS AND COMMENTS

ON THE SOURCE OF COPPER AT THE ETOWAH SITE, GEORGIA

For some time it has been almost tacitly accepted that most or all of the pre-Columbian copper artifacts found in the eastern United States were manufactured of native copper recovered from the glacial drifts of the western Great Lakes region (Martin, Quimby, and Collier 1947: 40-2). This assumption can be attributed to a number of factors: (1) the abundance of copper artifacts in the Old Copper and Middle Woodland cultures which center in or are immediately adjacent to this region; (2) the quantity and availability of the copper; (3) the notion that other deposits were not accessible to pre-Columbian users, or were at least not numerous; and finally, (4) all the copper artifacts so far analysed show compositional similarities to the Great Lakes copper.

Current excavations in Mound C at the Etowah site, near Cartersville, Georgia, under the direction of the junior author, for the Georgia Historical Commission, have produced an abundance of copper in the form of ceremonial ornaments, weapons, and other paraphernalia. At the suggestion of the senior author a specimen was submitted to him at the Georgia Geologic Survey's Department of Mines, Mining, and Geology. It was spectrographically analysed, along with samples of native copper from several source localities in southeastern United States and Michigan. A comparison of the trace element assemblages of these specimens provides a basis for deciding whether the Etowah copper is similar to that from the Great Lakes region or whether it more closely resembles native copper from a nearby source.

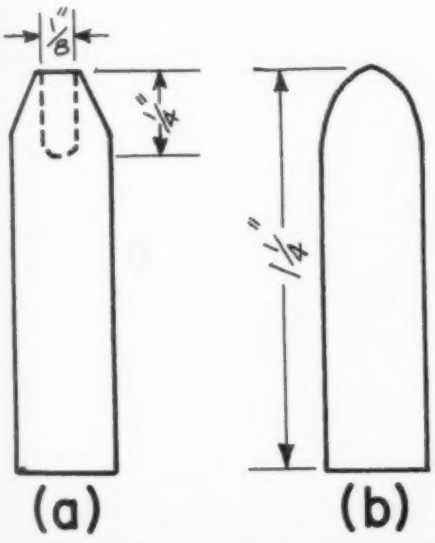

FIG. 1 [Hurst and Larson]. Dimensions of the lower (*a*) and upper (*b*) electrodes.

Description of Specimens. Nine specimens were analysed.

No. 1 is the Etowah specimen, a copper celt 6½ inches long, 2¾ inches wide at the bit, and up to ⅛ inch thick. It is oxidized on the surface but unaltered in the core, which is the part used in the analysis. The celt was not treated in any way by attempts to preserve or clean it, except to brush away the soil which adhered to its surface. The celt was found in a grave associated with several other objects readily recognized as belonging to the Southern Cult Complex: 2 undecorated conch shell bowls; 2 headdresses composed of embossed sheet copper symbol badges (2 types of batons, plumes, and arrows) and a small sheet copper dancing human figure; a large embossed sheet copper gorget; 7 small sun symbols cut from sheet copper; 2 sun symbols cut from mica; a large stone celt; a cannel coal(?) celt; a wooden rattle carved in the shape of a human head and covered with sheet copper.

Little difficulty is experienced in assigning the celt to a relative position in the Southeastern chronological framework. It is on the same time level as other sites belonging to the phase of Southern Cult development which embraced the widest range of elaborate ritual equipment. More specifically, the celt is from that portion of Mound C which dates from the Wilbanks period in northwest Georgia (Sears 1952: 106).

Specimen No. 2 is amphibolite containing wires and shot-size masses of native copper, from Ashe County, North Carolina, about 5 miles from West Jefferson.

No. 3 is native copper from Oglethorpe County, Georgia; State Museum No. 3005.

No. 4 is native copper disseminated in quartz from Fannin County, Georgia; State Museum No. 3302.

No. 5 is native copper from Fannin County, Georgia, similar to No. 4 but without the quartz matrix; State Museum No. 3279.

No. 6 is a native copper nugget from Santa Rita, New Mexico.

No. 7 is native copper, occurring in analcite, from an unrecorded locality in Michigan.

No. 8 is native copper in amygdaloidal diabase from Antonagon County, Michigan.

No. 9 is native copper in a basic volcanic rock from Michigan, exact location unrecorded.

Preparation and Analysis of the Samples. Fine copper turnings were obtained from the Etowah celt by drilling several holes into one edge with a high-speed bit; turnings free of carbonate and stain were selected for analysis.

Samples of specimens 3, 5, 6, 7, 8, and 9 were pared off with a knife. Numbers 2 and 4 were first crushed to free the copper from the matrix, after which suitable samples were picked out with a probe.

Only well cleaned, hard metal surfaces were allowed to contact the copper samples and electrodes. Drilling and paring were done with a minimum of pressure to prevent contamination by abrasion of the tools.

The electrodes were shaped on a lathe to the dimensions in Figure 1 from National Special Grade graphite rods ¼ inch in diameter. A large Littrow quartz spectrograph, with a dispersion of 2.5 A/mm at 2500 A and 7 A/mm at 3400 A, was used to record the range 2485-3475 A on a 10" Eastman SA No. 2 plate.

The samples were excited by a DC arc current of 300 volts and 9 amps., with an arc gap of 5 mm; slit width 10 microns. Each set of electrodes was given a preburn of 2 seconds, after which additional copper was added. This was followed by a second preburn of the same duration, which left the cup of the lower electrode filled by a cop-

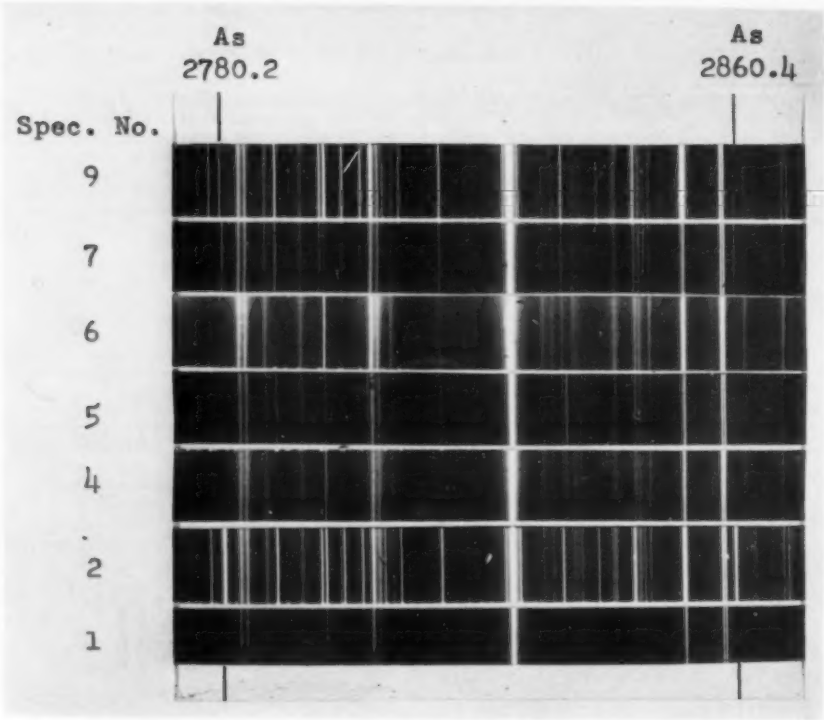

FIG. 2 [Hurst and Larson]. A comparison of 7 spectra. Only No. 2, the specimen of native copper from North Carolina, and Nos. 7 and 9, the specimens from Michigan, show the As lines.

per bead of uniform size well-suited for steady arcing. A reference iron spectrum was juxtaposed with that of each sample, by means of a Hartmann diaphram. Exposure: 20 seconds for the copper, 3 seconds for the iron. Plates were developed in D19 for 4.5 minutes at 20° C (Fig. 2).

As the experimental conditions show, no attempt was made to achieve maximum detection of trace elements. Some care was given, however, to the shaping of the electrodes, preparation, sizing, and packing of the samples, and excitation and plate development conditions to insure that the spectra are comparable.

Results and Discussion. A superficial examination reveals that the spectrum of sample 3 is uniquely different; it is therefore not considered further as a possible source for the Etowah copper. The trace element assemblages of the other 8 specimens are compared in Table 1. The numbers indicating relative abundance are based on the presence or absence of the analytical lines tabulated by Stich (1953: 7-10).

The table shows that 7, 8, and 9, the Michigan specimens, are remarkably similar. No. 2, from North Carolina, differs from the others by its high content of nickel, titanium, manganese, and arsenic. No. 6, from New Mexico, is similar to 7, 8, and 9 but differs in several ways: cobalt is present; aluminum, manganese, and arsenic are not detected. Numbers 1, 4, and 5 are similar; 1 and 5 are identical except in Pb content. No. 1 is the copper celt from the Etowah site. Numbers 4 and 5 are native copper from Fannin County, Georgia.

Iron, silicon, aluminum, and magnesium are major elements in the minerals associated with the native copper. Though care was taken to eliminate these matrix minerals during sample preparation, microscopic inclusions might have passed unnoticed, and some contamination could have taken place by mechanical admixture during the drilling and paring. These elements are therefore regarded as secondarily important in the trace element comparison. The most significant elements probably are nickel, cobalt, arsenic, and phosphorus.

A trace element comparison has been used previously to trace the geographic origin of native metal. In one interesting case (Warren and Thompson 1944) it was used to determine the source of stolen gold. To be successful, a trace element comparison must be sufficiently discriminating to bring out *differences*, as general compositional similarity can be expected of most specimens of a native metal.

Embossed sheet copper plates which exhibit close cultural affinities to the Etowah copper and are from the

TABLE 1. TRACE ELEMENT COMPOSITION OF 8 NATIVE COPPER SAMPLES

Numbers indicate relative abundance; marked 0 when not detected.

Sample No.	*Fe*	*Si*	*Al*	*Mg*	*Pb*	*Ag*	*Ni*	*Ti*	*Mn*	*Co*	*V*	*As*	*P*	*Pt*
1	10	6	10	5	0	2	0	7	0	0	0	0	0	0
2	14	20	12	13	4	2	8	11	12	0	6	14	10	2
4	6	15	10	10	8	2	0	6	0	0	0	0	0	0
5	10	6	9	5	9	2	0	6	0	0	0	0	0	0
6	14	15	0	5	6	2	6	10	0	10	0	0	10	0
7	12	14	11	12	6	2	6	6	8	0	*	10	10	0
8	12	15	11	11	0	2	6	6	8	0	*	10	10	0
10	12	16	11	13	6	1	6	6	11	0	6	10	10	0

* Indeterminate due to plate fogging.

same time period have already been spectrographically analysed. The Wulfing Plates, Missouri, were analysed by Watson (1950) who found them remarkably pure and suggested an Upper Michigan source. The Mangum Plate, Mississippi, was investigated by Cotter (1952) who regarded the evidence as strongly in favor of a Michigan source.

The Etowah celt is remarkably similar in trace element composition to the native copper from Fannin County, Georgia; distinctly unlike native copper from Michigan and the other sources investigated. Instead of having been brought from Michigan, the Etowah copper was probably derived from a local source.

The Fannin County copper deposits belong to a geologic province which extends northeastward through Ducktown, Tennessee, and southwestward almost to the Etowah site. Native metal specimens from a single geologic province are often similar to identical in trace element composition. It is not expected that a trace element analysis as reported here could reliably distinguish the copper from different sites within the province, in every case. Therefore the Etowah copper might have come from Fannin County, Georgia, from Ducktown, Tennessee, or from another deposit within this province.

Natural Occurrence of Native Copper in the Southeast. Native copper has been found at dozens of localities in the Southeast, 3 of which are within 60 miles of the Etowah site (Fig. 3). At most of the localities it has been found within or just below the oxidized outcrops of copper-bearing sulphide veins.

At Ore Knob, North Carolina, seams up to 4 inches thick have been reported (Olcott 1875: 393). In Ducktown District of southeastern Tennessee small grains and shot-like masses have been encountered in the secondary ore (Emmons and Laney 1926: 50-1). Fist-size chunks of native copper disseminated in quartz, as well as nuggets more than ½ inch thick from Fannin County, Georgia, are on display in the State Museum in Atlanta.

A map showing the distribution of the better known, copper-bearing sulphide veins in Alabama, Georgia, Tennessee, North Carolina, and Virginia has been published by Ross (1935: 17). Any one of these localities might have yielded native copper to pre-Columbian inhabitants.

In addition to the veins, metavolcanic rocks containing shots, wires, and irregular masses of native copper are known at several localities in North Carolina and Virginia.

There is some evidence that the Indians crudely smelted ore to obtain metallic copper, according to Heinrich (1895: 173). In Polk County, Tennessee, near the mouth of Mill Creek, within ½ mile of the Georgia-Tennessee line, James Parks in 1880 found pottery fragments, arrowheads, and other Indian relics with pieces of copper ore, slag, and a slab of metallic copper, which he believed to antedate the coming of white men. Although the white pioneers of the district left no other record of ancient workings, it is nevertheless true that large masses of ore were exposed at the surface and could have been roasted over wood fires by the Indians to obtain metallic copper.

Local supplies of copper were available to pre-Columbian inhabitants of the Southeast in ample quantity for the artifacts they manufactured, regardless of whether they smelted ore.

Summary. A trace element comparison of the Etowah celt with specimens of native copper from several localities in the Southeast and Michigan indicates that the copper in the celt was probably derived from a local source. While this comparison cannot be accepted as a final statement on the source of all the copper used in the Southeast during the Mississippi period, it does give reason for regarding with some skepticism the general assumption that all the copper originated in Michigan.

The similarity of copper artifacts from different Southern Cult sites is remarkable. Some are almost identical, for example, the copper eagles from Etowah (Moorehead 1932, Fig. 7), Spiro (Orr 1952, Fig. 136 *t*) and Malden,

Missouri (Fowke 1910, Pls. 15, 17-19); the copper arrow symbol badges from eastern Tennessee (Kneberg 1952, Fig. 109 *s*), Moundville (Moore 1905, Fig. 104), and Etowah (Georgia Historical Commission Collections). It has been suggested that these examples indicate a unified artistic inspiration. They also suggest the possibility of a single source of manufacture.

A careful analysis, where possible, of Southern Cult copper will give us further insight into the strength of this religious complex, and might yield important information on the extent of contact between different groups in the Southeast.

Acknowledgements. George Grumbles and Jeanne Shearer helped in measuring the spectographic plates. Specimen No. 2 was collected by Gilbert Withers. Specimens 3, 4, and 5 were provided by the Georgia State Museum, Anette McClain, Director. Specimens 6, 7, and 8 were supplied by J. G. Lester, Emory University; No. 9 by A. S. Furcron, Georgia Geological Survey.

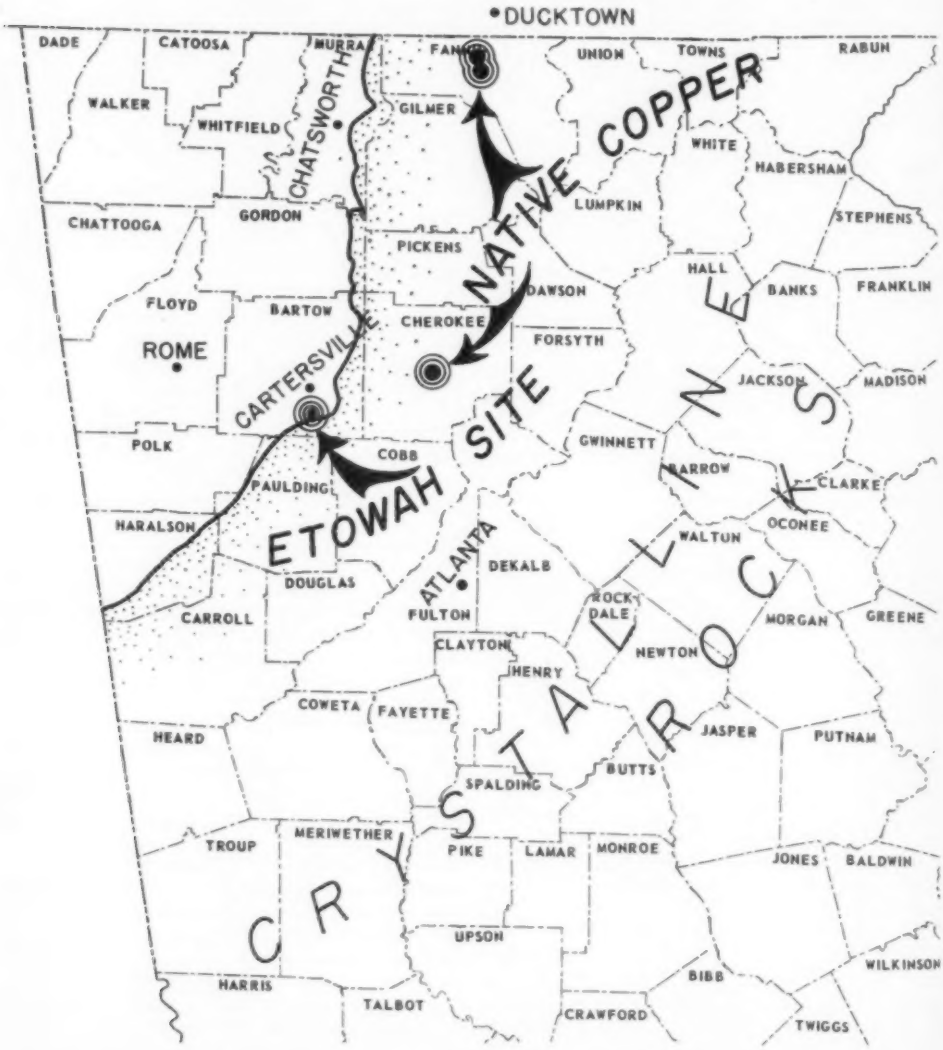

FIG. 3 [Hurst and Larson]. Occurrences of native copper near the Etowah site.

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VERNON J. HURST
Georgia Geologic Survey
Atlanta, Ga.

LEWIS H. LARSON, JR.
Cartersville, Ga.
April 1957

A HORIZONTAL-NECKED SHIRT FROM MARQUES, PERU

Shortly after an article describing a Peruvian shirt with a horizontal neck slot was published (Gayton 1955), a specimen with a similar aperture was unearthed at La Capilla cemetery on the Hacienda Marques. This specimen is sufficiently different from the other to warrant a brief report. The archaeological data are provided by Stumer, the textile data by Gayton.

La Capilla cemetery is on the Hacienda Marques at the mouth of the Chillón River, some 12 km. north of Lima. La Capilla lies at the extreme northwest corner of the irrigable lands of the Chillón and is the most extensive of the cemetery sites which dot the Hacienda Marques. It is the site which A. L. Kroeber excavated during his 1925-26 expedition (Kroeber 1954: 3, 10, 11, 27) and from which came some of the cadavers examined by Marshall T. Newman (1947).

The cemetery occupies an area approximately 500 meters square, and in recent times the superficial graves, which are practically all of Chancay culture, have been thoroughly looted. However, there is a stratum of graves underlying these in most parts of the cemetery which has been overlooked.

Stumer (1954) had examined this cemetery during the surface survey which preceded the Marques excavations of 1952-53, but during preparation of the final report returned to La Capilla to recheck the underlying stratum of graves. It was then that the shirt described here was encountered folded up as part of the inner wrappings of a funerary bundle containing the body of an adult male, apparently in his forties.

The grave, oriented north-south, was roughly rectangular in shape, about 80 by 85 cm. in size and 1.68 m. deep. There was a roof of willow logs and cane which had collapsed from the weight of overlying rubble. Beside the funerary bundle of the adult, there were simply wrapped bodies of 2 small children. As was usual in the La Capilla graves Stumer excavated, the bundle containing the shirt was not topped by a funerary mask.

Grave contents were simple and undifferentiated from other graves in the series. The contents were: 2 bundles of wooden digging tools, each containing some 7 examples; 11 gourds, 4 of which had been repaired; and 4 pottery specimens. One of these was a collared blackware jar, 42 by 23 cm. Another was a redware bowl, 15 by 12 cm., with a rim decoration of black, white, and red chevrons of Tiahuanacoid III style (Late Ancón I style; Strong 1925, Pl. 43). The other 2 vessels were simple, fire-blackened, collared utility ollas of the usual coarse redware type of the Central Coast in the Late periods.

From the grave associations and observations of the other graves in the series, Stumer places the La Capilla shirt chronologically as Late Tiahuanacoid III or, at the very latest, very early Chancay. Quite definitely, it seems to date from that twilight area where the last vestiges of Coast Tiahuanaco are disappearing to be replaced by the pre-Inca Chancay style of the Central Coast. In July 1957, excavating again at La Capilla, Stumer encountered

architectural remains adjacent to the grave from which the shirt came. Classic Chancay graves are superimposed on the architecture; the lower grave group, including that of the shirt, are beneath the architecture. This clearly confirms the dating of the shirt and the associated artifacts and ceramics as Tiahuanacoid III.

The La Capilla shirt is distinguished not only by its horizontal neck slot but by 2 hand openings in the top edge of the garment. It is constructed of 2 identical long, narrow, rectangular webs seamed together at the narrow ends which form the wholly closed sides (Fig. 1). The upper edges of these paired, 4-selvage webs are stitched together, beginning a few centimeters in from each end and continuing toward the center where an opening is left. Thus there are 2 small transverse slots for the hands and a larger one for the neck in the upper horizontal edge of the shirt. The fabrics are of natural, creamy cotton, in a medium-coarse, warpface weave. No color or embellishment has been added. The garment appears to be purely utilitarian; soil and wear are evident.

The shirt is 132 cm. wide (warp length) and 46 cm. deep (weft width); the hand slots are 10.2 cm., and the neck slot 33 cm. The warp yarns are 1-ply, S-spun, slubbed; the weft yarns are 2-ply, initial spin Z, final S; the wefts are about twice the diameter of the warps. The thread count average is 19 warps to 7 wefts per square centimeter. The seam stitching is coarse whipping with paired threads similar to the weft yarns. Workmanship in weaving is fair, but there are slight variations in both thread count and cloth width. One web has 3 extra wefts toward 1 end where evening-up was attempted as the weaver approached the still obvious closure of the weaving. Both webs have short lengths of coarse cotton yarn (3-ply, final spin Z) run into the cloth a short distance up and in from a lower corner. These do not match in position; their ends are broken off, and their purpose unknown. The opposite corner where similar yarns may have been is destroyed.

The most interesting feature of the shirt is its hand apertures. Unlike the Ferdon shirt (Gayton 1955, Fig. 77) which has folded fabric on one side, thus precluding an end opening for the hand, the La Capilla shirt is seamed on both sides where openings could have been left. Leaving hand or arm slots in the vertical side seams is standard Peruvian practice, as it is the world over. The wide, short dimensions of the shirt are comparable to those of certain shirts from Ancón, although the latter have the usual vertical apertures (compare Reiss and Stübel 1880-87, Pl. 35, Nos. 3, 4; Pl. 36, Nos. 3, 5, 6). The construction plan and appearance of the La Capilla shirt when worn are shown in Figure 1.

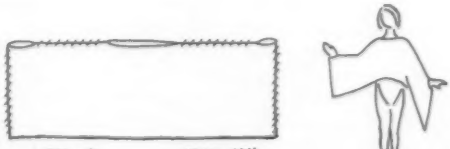

FIG. 1 [Stumer and Gayton]. The La Capilla shirt construction and its appearance when worn.

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LOUIS M. STUMER
Universidad Nacional Mayor
de San Marcos de Lima

A. H. GAYTON
University of California
Berkeley
June, 1957

A MONOLITHIC AX FROM ALABAMA

An elaborately carved fragment of metamorphosed schist was sent to me not long ago. I was told that it was plowed up in a field near Fosters, Alabama, which is approximately 7 miles north of Moundville State Park and thus well within the sphere of influence of that cultural center. The specimen is owned by James Willard Dorroh of Buhl, Alabama.

The object constitutes the major portion of a very beautifully carved monolithic ceremonial ax (Fig. 1) superficially resembling one in the Peabody Museum at Yale University (Cat. No. 3701) which has been described by Saville (1916: 5) and MacCurdy (1916: 301). The Yale specimen shows the figure of a man draped backward over the upper end of the handle. The well carved head rests upside down touching the butt end of the projecting blade. The newly recovered specimen has the upper end of the handle terminating in a full face view of a man whose face and ears are exposed leaving the head and neck portions covered with some sort of a tight fitting tunic or covering. The rendition of the facial

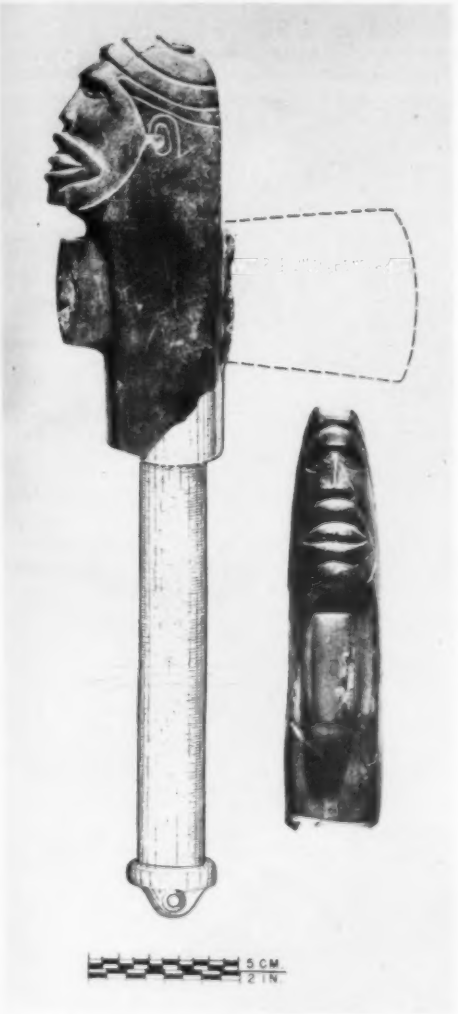

FIG. 1 [Miller]. Monolithic ax from Alabama.

features is much better than in the Yale specimen. The elliptical eyes, the flat nose with the flaring nostrils, the partially open mouth with its thick lips and partially protruding tongue, the heavy brow ridges beneath a low sloping forehead all have a naturalistic look.

While the Yale ax is complete the Fosters ax is only a fragment. There is enough to make a restoration quite exact. At the base of the break, at the top of the helve or handle, there is an indication that the handle was once round in cross section. It is surmised that the base of the handle formed an annular swelling or pommel terminating in a perforated protuberance similar to other monolithic axes from this vicinity. Above the rounded portion of the handle it suddenly becomes squarish in cross section before reaching the level of the hafting, giving to the back of the handle a prominent, squarish, well-developed stop or guard which is more pronounced than that on the Yale specimen. The poll is flat while the edges of the blade flare outward, as shown in the reconstruction. Whether the ax was ceremoniously "killed" or accidently broken is not known. No other pieces of this ax have been found so far.

Moorehead (1932, Fig. 52 *a*) illustrates an excellent example of a complete bluish-gray limestone ax from the Etowah Mound group which is artistically fashioned and very highly polished. This ax was associated with burial 50 which occurred just outside of the limits of Mound C. He reports that fragmentary axes were recovered from the surface of this same site as well as from the Hawkins site some 9 miles away. Webb and DeJarnette (1942: 299) show the distribution of this type of object and demonstrate that there is no specific area of concentration. These artifacts are thinly dispersed over most of the southeastern states.

Waring and Holder (1945: 11, Fig. 2 *f-k*) include the monolithic ax among the "ceremonial objects" of the Southern Cult, which they interpret as deriving "at a relatively late date from elements introduced from Middle America."

In my opinion, this is the finest example of aboriginal carving which has come out of the Southeastern United States, especially Alabama. It was probably associated, in late prehistoric times, with the Southern Cult and the large pyramidal temple area at Moundville.

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CARL F. MILLER
Smithsonian Institution
Washington, D.C.
November, 1956

THE FIRST PEOPLING OF THE NEW WORLD

As a footnote to Ralph Beals' most interesting discussion of Father Acosta's views on the peopling of the New World in the October 1957 issue of AMERICAN ANTIQUITY (Vol. 23, No. 2, pp. 182-3), one might note the claim of Thomas Gage, author of the *English-American, a new survey of the West Indies*, to be the first to develop thoroughly — certainly in English — the "Men out of Asia" via Bering Strait thesis. In 1648 he wrote:

> Quivira is seated on the most western part of America, just over against Tartary, from whence being not much distant, some suppose that the inhabitants first came into this new world. And indeed the Indians of America in many things seem to be of the race and progeny of the Tartars, in that Quivira and all the West side of the Country towards Asia is far more populous than the East towards Europe, which sheweth these parts to have been first inhabited. Secondly, their uncivility, and barbarous properties tell us that they are most like the Tartars of any. Thirdly, the West side of America if it be not continent with Tartary, is yet disjoyned but by a small strait. Fourthly, the people of Quivira nearest to Tartary, are said to follow the seasons and pasturing of their cattle like the Tartarians.

Gage goes on to describe the kine of Quivira, under the impression that the buffalo was domesticated.

[EDITOR'S NOTE: an American edition of Thomas Gage prepared by Thompson has been published by the University of Oklahoma Press.]

J. ERIC S. THOMPSON
Harvard, Ashdon,
Saffron Walden, Essex
England
January, 1958

A POTTERY BELL FROM NORTHWESTERN NEW MEXICO

A fairly large fragmentary pottery (Fig. 1) bell was "rediscovered" some months ago while several of us were systematizing archaeological materials stored in the Laboratory of Anthropology at Santa Fe. Although the piece was probably excavated in the late 1920's or early 1930's, it has never been reported. The bell was included with Jemez area archaeological materials, studied and reported by the late Paul Reiter (1938: 155-7, Pl. XXII *b*, *c*). Possibly Reiter did not consider this part of a bell, or it may have been overlooked. In any event, because such items are rare, this object should not pass unnoticed.

Unfortunately we do not know the excavation circumstances, but, since it was boxed with Unshagi Pueblo clay objects, it is probably safe to assume that the bell came from this site. Unshagi, according to Reiter, was occupied between A.D. 1375 and 1682 (Pueblo IV).

This bell fragment holds the unique position of being the only one, of either copper or clay, from this part of northwestern New Mexico, in spite of many years of excavation and reconnaissance in the Jemez district. Apparently the original bell was imported to Unshagi, probably from one of the sites to the south, along Jemez Creek in the vicinity of Zia pueblo, for it is basalt tempered. It is made of fired, unslipped culinary ware with a dark gray appearance on the outside and a buffish-gray cast on the interior. The fragment comprises the upper part of the bell, intact, plus a small portion of the body, or resonator. Aside from a distinct ridge, encircling the lower edge of the top, there is no embellishment. The bell measures 1⅜ inches high; 1⅜ inches by 1⅝ inches wide. The eyelet has an exterior width of ½ inch, and an interior diameter of ⅛ inch. If complete, the bell would be about 3 inches long. The body thickness, below the ridge, ranges from slightly less than ⅛ inch to ⅜ inch.

An examination of the interior indicates that the top, and perhaps the entire bell, was made of clay modeled together. The original would have been pear-shaped, or spheroidal, but certainly not flat as were a number of Pecos pottery bells (Kidder 1932: 138). However, Kidder's descriptions of one group of bells from this site suggests how the Jemez specimen may have been manufactured:

> B. FLAT BELLS. The bells of this type (fig. 119, *a*, *b*, *d*) were modelled entirely by hand. A lump of clay was patted thin, pinched and worked to disc-like shape and then folded upon itself in such a way as to bring the edges close together, while leaving an inner open space to hold the clapper-pellet. . . . A long dimension of 2

FIG. 1 [Lambert]. Jemez clay bell. *a*, profile showing the eyelet and resonator below the ridge; *b*, view looking down on top of bell.

inches seems to have been standard. Very few are smaller than this, but several fragments appear to have belonged to specimens considerably larger, some perhaps of nearly 3 inches. All are of light construction and so produce a sound more staccato than that of the thick globular bells.

Although never common in the Southwest, copper bells have regularly appeared in a number of Pueblo sites, in the Hohokam area, and in a few Mogollon ruins. The total number would be increased slightly by specimens in private collections. In addition, clay bells which undoubtedly are facsimiles of the copper examples have also been reported. Besides the one from Unshagi, the only other known New Mexico pottery bells are a fragmentary one of Pueblo III period (Mimbres) from Luna County; an incomplete specimen from Pottery Mound, near Albuquerque (Pueblo IV); and 189 from Pecos Pueblo, which date about A.D. 1500-1600. However, the Jemez bell, in its entirety, would not have closely resembled any of the above. It does show some similarity perhaps to the large Mammoth, Arizona copper bell (Haury 1947: 80-2), and to some of the larger metal bells from Mexico. The Indian who fashioned the Jemez specimen was certainly familiar with metal examples of the same general style, probably copying it from one or more he had seen and admired.

Pottery bells have also been found in Arizona. One is from the Twelve Mile site (Hohokam), and another was excavated in a Mogollon-Hohokam site near Dragoon, Arizona (Allen 1953). At Awatovi, in the Jeddito Valley, Fewkes excavated 6 pottery bells in the "westernmost or oldest section of Awatobi," and at the same site and also at Kawaika-a, Brew found 89 additional pottery bells of Pueblo IV and V periods (Withers 1946: 52).

As is true in regard to copper bells found in the Southwestern United States, the majority of pottery facsimiles have also come from Pueblo sites. Considering the fact that over a half a century of reconnaissance and excavation have been carried on, the total number of pottery bells (289) is surprisingly small, especially when coupled with the fact that only 6 pueblo ruins, 4 in New Mexico, and 2 in Arizona, are represented. The entire Hohokam area has produced only 2. Furthermore, all but 5 of the finds have come from Pecos and the 2 sites in the Jeddito Valley. It is also likely that if there exist privately-owned pottery bells, the number would not appreciably swell the known total. Fired clay bells have also been recovered in the Valley of Mexico and at Quirigua, Guatemala, in the regions close to the source of manufactured metal bells. Both metal and clay bells appear to be characteristic of only the Southwest and Mesoamerica.

Perhaps the following statement by Withers (1946: 53) may explain, at least in part, the impetus behind the making of clay bells in the Southwest:

> It is significant that pottery bells occur late in protohistoric and historic times and have not been found at any site where copper bells have also been discovered. Apparently these clay bells were made in the localities where they have been found, and suggest a home-made substitute for metal bells. Whether this substitution was necessary because copper bells were not then being made, because metal bells had stopped being traded in, or simply because copper ones were rare, cannot be told at this time.

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MARJORIE F. LAMBERT
Museum of New Mexico
Santa Fe, N. Mex.
June, 1957

THE RADIOACTIVITY OF MATERIALS FROM THE SCHARBAUER SITE, NEAR MIDLAND, TEXAS

It was shown by Bowie and Davidson (1955) that measurement of the beta radioactivity of fossil bones in a mixed assemblage is a useful means of determining their relative ages. Buried bones and teeth adsorb uranium from percolating ground water, so that with the passage of time there is an increase in their radioactivity. There can be no confusion with the decreasing radioactivity of the carbon-14 of residual collagen in fossil bones, for this is far too feeble to be measured by the technique employed here. When fresh bone is tested by the present method no radioactivity can be detected. The uranium content of a fossil bone depends not only on the length of time that it has been buried, but also on the permeability of the matrix, on the hydrological conditions at the site, and on the uranium content of the water coming into contact with the specimen. However, in favorable circumstances it is possible to separate bones of different geological ages by comparing their radioactivity. Radiometric analysis is therefore a valuable supplement to the fluorine method of relative dating and has the advantage that it does not necessarily involve destruction of the specimen. Like the fluorine method it is particularly valuable for distinguishing bones which have been interred in a deposit containing fossil bones of much earlier age. Since the passage of uranium is to some extent inhibited by calcium carbonate and clay, the method is best suited to the relative dating of bones in sand or gravel matrices.

When Fred Wendorf heard that we had installed equipment at the British Museum (Natural History) for

radiometric analysis of fossil bones, he readily agreed to the suggestion that the analytical data bearing on the antiquity of the human remains from Midland, Texas, might be usefully supplemented by the application of this new technique. Accordingly he submitted to our Paleontological Laboratory all the available residues of the bone samples analysed for the Midland report (Wendorf and others 1955, Table 7).

In the method which we employed, specially designed for assaying minimal quantities of material, one cubic centimeter of bone powder is placed on a watch glass (diam. 5 cm.), levelled, and then racked up on a brass support to a standard distance (¼ in.) below the mica end window of a vertical Geiger-Müller tube. The whole assemblage is enclosed within a lead castle which cuts down extraneous radiation to a minimum, and the Geiger-Müller tube is connected to a scaling unit.

The radioactivity of the sample, together with any residual extraneous radiation (background), is recorded as the average number of radiations per minute in six 30-minute periods of counting. As the background count is fluctuating, the powder sample is removed after each half-hour period of counting, and the background alone counted for the same period of time. The standard deviation of the background count relative to the count of sample plus background is then calculated. By extrapolation from measurements of the radioactivity of an analysed standard consisting of sand and powdered pitchblende, it is possible to convert the net count rate of each sample into equivalent urania content ($e.U_3O_8$).

The Midland samples were assayed by Valerie Williams under our supervision. The results set out in Table 1 provide further confirmation that the remains of Midland Man are contemporaneous with the Gray Calcareous Sand in which they were found. Several points call for comment.

It has already been established that adsorbed uranium is not uniformly distributed throughout the thickness of a bone or tooth, particularly where more than one type of tissue is present. Thus uranium tends to be concentrated on the surface of dental enamel, and may not penetrate the enamel at all. This tissue is therefore particularly unreliable for purposes of comparative assay. Uranium is adsorbed more uniformly by exposed dentine, which has about the same powers of absorption as compact bone. The powdered tooth samples in the Midland series (5627, 5629, 5622, 5623, # 1) consisted of variable mixtures of enamel, dentine, and cementum. Consequently their radioactivity is very erratic in comparison with that of the bone samples in which uranium occurs more uniformly. From the few figures available it appears probable that the average radioactivity of bones (expressed as equivalent urania) progresses regularly with age at this site.

Horizon of Bones	*Average $e.U_3O_8$ p.p.m.*
Modern	<1
Red Sand	4
Gray Sand	12
White Sand	21

The fact that the 2 separate powder samples of the human skull (5626 and # 5), assayed at different times, gave identical results may be taken as an indication that the variations in the other radioactivity figures represent actual differences in composition of the specimens and are not a reflection of faulty assaying technique.

The pronghorn tooth from the humic zone of the Red Sand is of particular interest because its lack of radioactivity has 2 possible explanations. Either this is a

TABLE 1. "URANIUM" CONTENT OF MATERIALS FROM MIDLAND MAN SITE, TEXAS.

Specimen No.	*Laboratory No.*	*Stratigraphic Unit*	*Specimen*	*"Uranium" ($e.U_3O_8$ p.p.m.)*
1	5620	Modern	Cottontail rabbit bone	<1.00
2	5621	Modern	Cottontail rabbit bone	<1.00
3	5627	Humic zone of sand (3)	Pronghorn tooth	<1.00
4	5628	Red aeolian sand (3)	Turtle carapace	4.44 ± 1.66
5	5629	Red aeolian sand (3)	Horse tooth	2.34 ± 1.65
6	5626	Gray calcareous sand (2)	Human skull	13.27 ± 1.74
7	# 5	Gray calcareous sand (2)	Human parietal	13.04 ± 1.73
9	5622	Gray calcareous sand (2)	Horse tooth	29.37 ± 1.93
10	5624	Gray calcareous sand (2)	Horse radius	10.83 ± 1.74
11	5623	White sand (1)	Horse tooth	24.92 ± 1.04
—	# 1	White sand (1)	Horse tooth	102.25 ± 2.43
18	# 2	White sand (1)	Misc. bones	14.63 ± 1.74
19	# 3	White sand (1)	Misc. bones	27.61 ± 1.85
—	# 4	White sand (1)	Horse toe-bone	24.43 ± 1.84
21	# 6	White sand (1)	Antelope tooth	(Insufficient for assay)

recent specimen that has worked down from the modern soil, or it is contemporaneous with the Red Sand, in which case the uranium that it originally adsorbed has been removed by leaching under humic conditions.

The "build-up" of radioactivity of a fossil bone is not only due to the progressive accumulation of adsorbed uranium in time, but also to the continuous production by this uranium of radioactive daughter elements, protoactinium, ionium, radium, and so forth. The bone's content of these transitory disintegration products increases to a maximum which is reached when the amount of each element generated in a given time balances the amount lost by radioactive decay. This point of equilibrium is delayed by fresh accretion of uranium, but may be accelerated by differential leaching. Approximate secular equilibrium is generally reached after several hundred thousand years. Thus, the radioactivity method of relative dating is better suited to separating Late Tertiary or older Pleistocene bones from younger specimens, than to separating Late Pleistocene material from recent, because the radioactivity increases more steeply as the adsorbed uranium approaches secular equilbrium with its daughter elements.

The possibility that the radioactivity of fossil bones might provide some indication of absolute age has been considered, but the number of incalculable variables is so large that it has generally been considered out of the question. However, Hoye Eargle and John N. Rosholt of the U.S. Geological Survey have informed us that after making certain assumptions it is possible to calculate the probable maximum age of a fossil bone by estimating the abundance of uranium and daughter elements in the material. To what extent the assumptions are justifiable will vary from site to site, but it is hoped that used with fluorine analysis and radiocarbon estimations as means of checking rates of deposition the uranium dating method may have some valuable applications.

After this paper was written Rosholt read a paper on "Evaluation of a Pleistocene Dating Method Using Uranium and Daughter Product Relationship" at the Atlantic City meeting of the Geological Society of America. In it he concluded that a comparison with the available radiocarbon dates indicates that estimated ages of bones from radiochemical analyses are not sufficiently reliable for archaeological purposes.

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Kenneth P. Oakley
Arthur E. Rixon
Palaeontological Laboratory
British Museum (Natural History)
London, England
January, 1957

COMMENTS ON THE SAN JOSE RADIOCARBON DATE

In 1937 John M. Goggin found a series of blow-outs in the San Jose river valley, western New Mexico, which produced serrated projectile points reminiscent of Pinto Basin material. The following year Joseph H. Toulouse, Jr., identified 3 distinct cultural horizons, each with an associated sand stratum (Bryan and Toulouse 1943). The most recent stratum, made up of loose drifting surface sand, contained Pueblo and recent cultural debris. Beneath this was a layer of consolidated buff to white colored sand identified as late dune. In this stratum were found diagnostic milling stones and the distinctive small, serrated Lobo point. Under this buff sand lay a compact layer of red sand, old dune, with similar milling stones but with a larger serrated point type today known as the San Jose. This old dune stratum also produced 4 blades or projectiles classified by Bryan and Toulouse as simply generalized Yuma types.

Following the work of Bryan and Toulouse the Grants area received little archaeological attention until 1952 when we reworked the 12 known sites in the vicinity of Grants and in addition found similar cultural horizons at Laguna, Cañoncito, Suwanee, and Puerco Station. Subsequently we found evidence that the Lobo, San Jose, and generalized Yuma projectiles were to be found the entire length of the San Jose valley (Agogino and Hester 1956).

We collected charcoal samples from sites originally described by Bryan and Toulouse. Samples were obtained from a hearth in the old dune level at Grants 1, and were submitted to the University of Michigan Memorial Phoenix Project Radiocarbon Laboratory. Sample M-346 was given an age of 6880 ± 400 years ago. This is the only date so far obtained from the old dune level of San Jose.

During the process of collecting an adequate charcoal sample at Grants 1, we found in a 2 inch section of charcoal approximately 100 slightly charred and blackened amaranth (pigweed) seeds. The seeds, like the rest of the charcoal sample, were removed from near the top of the red old dune level. The seeds were found 6 inches below the hearth surface and did not appear to be intrusive. Volney H. Jones of the University of Michigan identified the seeds as those of an uncultivated variety and smaller than those of wild amaranth growing today.

Amaranth seeds grow in clusters at a convenient height and fall readily when ripe. Therefore, considerable amounts of this food could easily be obtained by using a basket and seed beater (Jones and Fonner 1954). Since milling stones were found in the same hearth as the seeds they may have been used to grind the seeds for food (Agogino and Feinhandler 1957). The finding of amaranth seeds in a hearth in the old dune level at San Jose extends the possible cultural use of this plant for the first time into an era before the birth of Christ.

Antevs (1948) and Bryan and McCann (1943) state that the old dune cultural horizon at the San Jose sites was associated with the beginning of a warm dry period in the Southwest known as the Altithermal. This is in

general agreement with the date of ca. 7500 B.P. obtained by the geologic-climatic method of dating (Antevs 1955).

Some question has been raised regarding the possibility of 2 cultural horizons in the old dune level, because 2 distinct projectile types have been found in this consolidated red sand stratum. In addition to the typical serrated San Jose projectile, a smooth-edge parallel-flaked point occasionally is found. Bryan and Toulouse (1943) referred to these points as generalized Yuma types; we call them parallel-flaked points. We found 12 at a single site, Grants 12, and scattered evidence of similar projectiles throughout the entire San Jose valley. Agogino (1957) suggests that these points may underlie the serrated projectiles. However, we agree that both point types could have been made by the same cultural group. They are of similar size, exhibit similar basal grinding, and occur together in the same sites. Extensive excavations must be conducted before more reliable conclusions can be formed.

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George A. Agogino
Syracuse University
Syracuse, N.Y.

Jim Hester
University of Arizona
Tucson, Ariz.
December, 1957

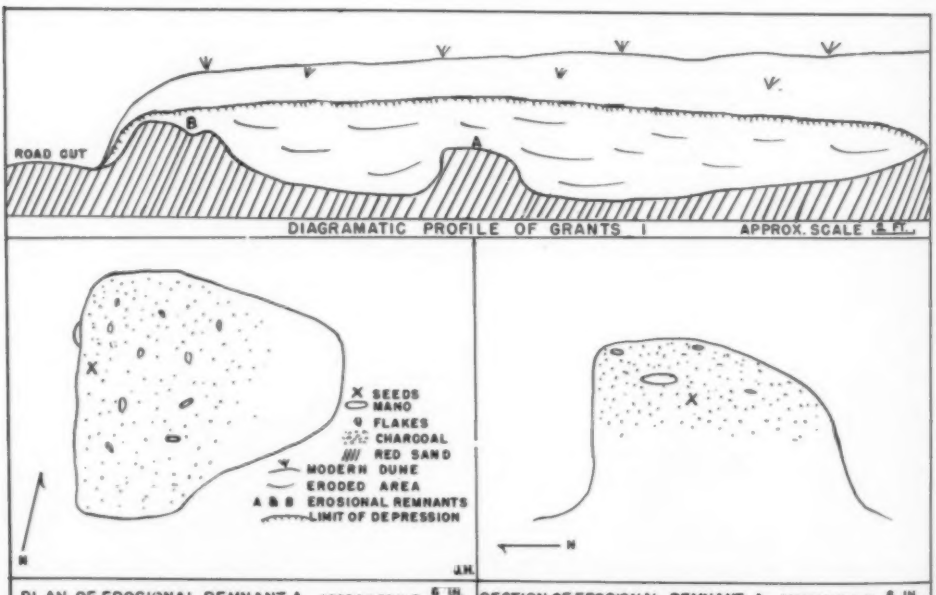

Fig. 1 [Agogino and Hester]. Profile of Grants 1 with details of erosional remnant A.

COMMENTS ON RYDÉN'S REVIEW OF HEYERDAHL AND SKJÖLSVOLD

The purpose of a review of a scientific monograph is twofold: 1) to give a brief summary of the contents, organization, methodology, and main conclusions of the work; and 2) to comment critically on its contribution in the light of the author's aims and techniques. Unfortunately, the recent review by Stig Rydén (1958, AMERICAN ANTIQUITY, Vol. 24, No. 1, pp. 88-9) of Heyerdahl and Skjölsvold, *Archaeological Evidence of Pre-Spanish Visits to the Galápagos Islands* does not serve either of these purposes.

No one reading Rydén's review can get an accurate idea of the contents of the monograph under discussion, the type and amount of evidence found, the number of sites encountered, or the conclusions. Rydén admits "that it is difficult for me to evaluate Heyerdahl's and Skjölsvold's research on the Galápagos without having personally inspected the objects recovered," but nevertheless condemns the report because the majority of the pottery is plain ware, there are no sherds from vessels of Incaic shape, and the identification of some specimens as Coastal Tiahuanaco seems tenuous. He then states that "the material does not furnish any direct confirmation of the theory launched by Heyerdahl that Polynesia was settled by a Tiahuanaco-derived people, or that in the process, the Galápagos Islands were used as a stopover."

Regardless of whether one agrees or disagrees with Heyerdahl's other writings, there is no mention of the above theories in this monograph. There is no statement nor implication that the archaeology of the Galápagos Islands proves any theory except that prehistoric South American peoples succeeded repeatedly in reaching the Galápagos Islands. The majority of the review sets forth in detail Rydén's theories on the subject of the post-Conquest versus pre-Conquest appearance of sails and the use of *guaras* as "ceremonial spades" instead of centerboards or steering boards in raft navigation. Rydén contends that negative evidence rules out the pre-Columbian use of sails, consequently the Galápagos could not have been reached in pre-Columbian times. Therefore the sherds found by Heyerdahl's expedition must be post-Columbian in origin.

As one who personally compared the Galápagos Islands sherds with type specimens from Peru and Ecuador when Heyerdahl was in Washington at the United States National Museum, I think that American archaeologists should recognize that other significance can be attached to the data. The conclusion that there were pre-Spanish visits to the Galápagos Islands is based upon a total of 11 campsites on 3 different islands, from which a total of 1988 sherds, 1 clay whistle, 4 flints, 1 obsidian object, and 2 chalky stone artifacts were recovered. They are well illustrated and described. Of this material, 1961 sherds were non-European and represent 131 vessels. It does not seem probable that the particular association of various pottery types at the campsites as shown on Table I of the report could be solely the result of post-Spanish occupation, as suggested by the reviewer. It would be next to impossible for the Spanish to have picked out the right pottery types from the various aboriginal periods and then to have broken them at campsites in exactly the correct cultural associations. It should be noted also that the large proportion of utility wares supports the interpretation that the sites were camps. Elaborate decorated types would not be expected under these circumstances. Another bit of interesting evidence that seems to support the conclusion that the contact is of aboriginal date is the presence of the same species of cotton as that cultivated on the Peruvian Coast in the pre-Spanish aboriginal periods.

Archaeologists should read this monograph as an interesting contribution to New World archaeology worthy of careful consideration in the light of the growing evidence of the role of movements by water in explaining cultural similarities between Mesoamerica and South America from the Formative Period upward in time. Whatever reaction one may have to Heyerdahl's earlier work or to his theories of settlement of the Pacific Islands, this should not be transferred uncritically to the Galápagos Islands monograph.

CLIFFORD EVANS
United States National Museum
Washington, D.C.
August, 1958

THE ALIBATES FLINT QUARRY, TEXAS

It has been thought that one of the most easily recognized types of flint used in the manufacture of stone tools in the Southern Plains is Amarillo or Alibates flint (Kidder 1932: 31, 44; Krieger 1946: 50, 62; Skinner 1956: 13). This flint has been widely recognized in Texas, central and western Oklahoma, southern Kansas, eastern Colorado and western New Mexico (Watson 1950: 32; Bell and Baerreis 1951: 84; Suhm and Krieger 1954: 71). The material has been dated as early as Folsom and as late as protohistoric (Roberts 1942: 18; Schmidt and Toldan 1953: 173; Baker, Campbell, and Evans 1957: 2). Although the quarry has been visited by a number of archaeologists, paleontologists, and geologists, few details concerning the quarry itself have been recorded. The initial description (Studer 1931) and a longer one by Bryan which is based on a visit with Studer in 1942 (Bryan 1950) are the most comprehensive studies of the quarry. The following expanded description results from a recent trip to the Alibates site in the company of Oren F. Evans and under the guidance of Studer.

The quarries are located about 35 miles north of Amarillo on the Bivins Ranch in Potter County, Texas. The outcrop of horizontal flint beds which form the quarry source is about a mile south of the Canadian River in the "brakes" or canyon country parallel to Alibates Creek, a tributary of the South Canadian. This remarkable concentration of exposed flint, approximately ¾ mile in length, was first discovered by Studer nearly 35 years ago while surveying for sites of the Panhandle Pueblo culture known now as the Antelope Creek Focus. An

interesting historical footnote is provided by Studer who states that the name Alibates by which the flint and the nearby stream are known is not a Spanish term but a corruption of the name of the original land squatter, Allen Bates.

The flint formation appears on the surface mainly along the back and eastern slopes of a spur or ridge which runs in a southerly direction between 2 canyons. Most of the exposure is along the eastern side of the ridge which slopes steeply but not vertically to a narrow alluvial valley some 100 feet below. The quarry averages 50 to 300 feet in width. Flint outcrops are especially prominent on the noses of the hills which jut into this narrow valley and which, allowing for irregular projections, form a slight arc. From the top of the ridge the South Canadian River is clearly visible. The exposure, while fairly extensive, is local in character. There is another outcrop to the north and east on Antelope Creek. There are, also according to Studer, flint outcrops which extend for 1 or 2 miles directly across the Canadian on the northern bank, but back in some instances as far as 3 miles. This material is inferior to that of the Alibates quarry and there is much less evidence of working. The only other known major prehistoric quarry source in the Texas Panhandle is at Quitique, some 70 miles southeast of Amarillo in Briscoe County. The flint is again of an inferior sort and the exposure is limited. Quarrying on a small scale is also reported from a number of other scattered sites in the Panhandle but they are of limited extent and of material which is inferior in quality to that of the Alibates quarry.

Quarry evidence at the Alibates site is of 2 kinds. First, there is an enormous concentration of flint chips, flakes, and cores mixed together with occasional large hammerstones, scrapers, knives, and points which litter the ground. In places this deposit is several feet thick. The debris is sporadic in distribution. It occurs mostly on the sides of some of the hills and in more favored locations although chips can be found almost anywhere. Second, the sides of many of the hills are pitted with depressions 5 to 20 feet across which are now almost filled with top soil. The depressions which are 1 to 2 feet deep represent the prehistoric quarry sites. In fact some of these hillsides look from a distance as if they had been peppered with artillery concentrations. Around the peripheries of these workings there is scattered flint debris which in some cases actually surrounds the depressions with low mounds. One of the larger workings which has possibly been enlarged through the curiosity of white prospectors is several feet deep and ringed by a mound 2 to 4 feet high. Altogether the amount of flint debris is considerable and together with the amount removed from the quarry must represent tons of material. The flint beds themselves appear to be almost horizontal but it is difficult to judge the exact thickness of the formation. Its greatest present exposure is about 4 or 5 feet. Some large boulders, which have been pried out or have weathered loose, are 3 to 4 feet in thickness.

The range of color in the formation is remarkable. While this fact is striking to the eye, it is even more interesting in view of the widely held notion that Amarillo or Alibates flint is characterized by a distinctive alternating red and white banding which may vary from red to brown and from white to cream or gray, often described as having the appearance of beefsteak. The general impression of the quarry material is that this warm reddish coloring is not dominant everywhere in the outcrop. In fact some outcrops lack any red coloration; at least one hillside is covered with a blue and white flint which shades to grays. While the site gives the impression of a range of colors in various combinations with blues rather than reds predominating in the debris, this situation is possibly not true for the formation as a whole.

Bryan (1950: 14) has this to say about the color of the flint:

> One of these pits has been excavated under Studer's direction. The flint is regularly but minutely banded in shades of blue-gray or red, with or without bands of white or pearl gray. Some pieces have spots of white on a red background and irregularities in the banding. Although the excavated pits and the refuse suggest that blue is the dominant color, red seems to have been preferred and is commonest in the implements of this flint found at a distance.

On this point Studer writes in a personal communication:

> The colors of the flint at the quarries, as you say, are wide and varied. Since red is a dominant color it would appear upon close examination that red predominates. That perhaps is not necessarily true. However, the projectile points, knives, and hide scrapers that were made by our local house building Indians were predominantly from the red flint. I do not know whether the red is of better quality or was simply more attractive to them, but I can safely say that the flint artifacts made by our local inhabitants were predominantly from the red-colored flint.

The high percentage of blue and white chips in the present debris may be the rejects; the more typically banded reds the select material. There is also the possibility that the blue and white flint which is found elsewhere in Texas in the larger artifacts such as choppers and axes may represent an earlier color preference, while the red banded flint may have been more favored in the late prehistoric period. These points are conjectural and will require study.

Bryan states that the distinctive but highly variable patterns of Alibates flint are easily recognized by persons familiar with the range and color of the flint from this particular quarry, but in the literature cited all references to its identification elsewhere refer solely to the distinctive red banded variety. If the trade material was the result of a definite color selection, this would seem to be an important point which might have temporal as well as cultural ramifications. If, on the other hand, the less distinctive blues which are often more diffuse in contrast to the distinctly banded reds, were also traded but have not been recognized, this is also an important point. It is, in fact, a point which could extend the distribution of this flint considerably and alter our concepts of early cultural contacts within the southern Plains and with adjoining regions.

This variation in flint coloration at the Alibates quarry demonstrates the need for additional objective techniques in order to correctly identify the quarry source even when the material is as distinctive and as well

known as that from the Amarillo district. It is to be hoped therefore that a combined macroscopic and microscopic method currently being developed by Evans to subsume the color variation within a particular quarry will prove fruitful.

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JAMES B. SHAEFFER
University of Oklahoma
Norman, Okla.
November, 1957

COMMENTS ON THE REVIEW OF "THE EFFIGY MOUND CULTURE OF WISCONSIN"

David Baerreis' review of *The Effigy Mound Culture of Wisconsin*, by Chandler Rowe (AMERICAN ANTIQUITY, Vol. 23, No. 3, pp. 320-1), includes certain criticisms of methods and procedures underlying the author's treatment of his subject that raise important questions as to the general status of archaeological concept and methodology.

For example, commenting on Rowe's rejection of the early guess that effigy mound shapes represent clan symbols, Baerreis appears to argue that at some time, some tribe or tribes could possibly have possessed totemic patterns that might account for effigy mound shapes. All that Rowe attempted to show is that past attempts "to assign the Effigy Mound Culture to *a specific* [the italics are mine] historically known Indian group" (p. 84) cannot be substantiated by available data. Is it proposed by the reviewer that failure to accept a supposition for which there is no adequate foundation in known fact amounts to questionable procedure? Nowhere does Rowe reject the possibility that the effigy shapes might represent totemic symbols. He refuses to accept any specific explanation as other than conjectural, and even includes as "highly speculative" his own general suggestion that these shapes may be associated with "certain ceremonial practices, perhaps some religious rite involving animals" (p. 90). Is this admirable caution, in the face of the limited, indefinite nature of available information, deserving of criticism?

Then Baerreis questions the author's position that the effigy mound builders apparently had a hunting and gathering economy, devoid of agriculture. Rowe's position is that not only is there no direct evidence of agricultural products that can definitely be assigned to the Effigy Mound people, but that there has not even been positive identification of a village site assignable to the authors of these mounds. There are smoking pipes, but tobacco trade and substitutes such as kinnickinnick could account for these, as in the case of known historic instances. I can only agree with Rowe that in the light of existing data, to postulate agriculture for this cultural manifestation amounts to unwise guessing. Of course, as Baerreis points out, the absence of supporting data "does not necessarily preclude horticulture," but it does relegate any assumption of horticulture to the category of the hypothetical, and it does justify the position that horticulture does not belong in the cultural picture until supporting data can be produced. Again the author is to be complimented, rather than criticized, for his caution.

But the most "fundamental" of Baerreis' criticisms of this report is that the author does not make use of typology in his descriptions of effigy mound artifacts. The complaint is that descriptions of pottery, projectile points, and the like are placed "in broad descriptive categories of little utility for comparative work." Actually, the instances of pottery occurrence definitely associated with effigy mound features, and thus acceptable as probably

the products of the mound builders, can be numbered on the fingers of one's 2 hands. And these, although generally western Woodland in character, represent close to the total variety in paste, shape, size, surface treatment, and decoration to be found within that broad Woodland category. Other potsherds that have been found loose in mound material, or situated on surfaces adjacent to the mounds, cannot definitely be ascribed to the effigy mound builders. How does one go about practicing "precise typology" under such circumstances, and what "utility for comparative work" would such typology provide?

This scarcity of cultural material, so characteristic in effigy mounds, is even more pronounced for stone projectile points, copper implements, objects of bone and shell, and pottery pipes. Any attempt at precise typology in each instance would be unprofitable and futile. Here again the author is subjected to criticism for exercising the critical caution which is, and must be fundamental in scientific procedure. The data adequate for any meaningful subdivision of Effigy Mound into "developmental stages" have not been collected. Until they have been made available, any method worthy of the name "scientific" requires us to hypothesize in terms of reasonably determinable facts, and to weigh the value of such methods as typology against the quantity of acceptable data available for study, no matter how unsatisfactory and emotionally disappointing the results may be.

Hypothesizing based upon indicative shreds of evidence may have value in exciting thoughtful, profitable controversy, but surely one should not be criticized for omitting such logical guessing from a report that has as its single objective the critical review of facts relating to a subject, and an evaluation of outstanding theories within the limited dimensions of those facts. That is Rowe's contribution to the subject.

W. C. McKern
Milwaukee Public Museum
Milwaukee, Wisc.
March, 1958

AN INSTANCE OF THE TRANSPORT OF ARTIFACTS BY MIGRATORY ANIMALS IN SOUTH AMERICA

In an article in this journal some years ago, Heizer (1944) brought together a number of recorded instances of the transport of artifacts by migratory animals. These instances consisted entirely of cases in which a bird, a sea mammal, or a land mammal had been wounded by man and, surviving the wound, had carried part of the weapon imbedded in its flesh, to some area many miles away. The eventual killing of the animal elsewhere led to the discovery of an exotic arrowhead, spear point, or harpoon head in the old wound. The occurrence of undetected instances of this phenomenon would naturally result in the deposition of artifacts far from their native area where, on the basis of ethnographic and archaeological evidence, they would not be expected to occur. Considering artifact transport by animals "a useful tool to explain some otherwise puzzling occurrence," Heizer (1944: 398) remarked that "it is to be desired that further data on this subject be made available."

Recently I came across an instance of the transport of artifacts by animals of an entirely different kind from that reported by Heizer. This case was reported by the British naturalist, John Graham Kerr, in a book published in 1950. The discovery however was made many years before, during Kerr's expedition to the Paraguayan side of the Pilcomayo River in 1889-91. On cutting open the stomach of a rhea (*Rhea americana*), Kerr found among the contents, 3 stone artifacts which the animal undoubtedly had swallowed as gizzard stones. Kerr's (1950: 126) brief interpretation of the incident follows:

> In this region of the Chaco with its complete absence of hard rock we may take it that there was probably never a purely Stone Age comparable with that of other parts of the world. But yet there were in past times stone axes and hammers. We know this through the present-day archaeological collectors of the Chaco — the ostriches which, in the absence of pebbles, eagerly snap up any stone implement they may encounter. In Plate XVI (*b*) are shown two stone axe-heads and a hammer, each composed of volcanic rock from some far-distant region. To what extent they owe their presence in the particular locality where found to barter from tribe to tribe in former days or on the other hand to the wanderings of ostriches from which they were obtained is a question which cannot be settled.

Plate XVI (*b*) of the book shows the implements to be: (1) a ground and polished stone celt, round in cross section and with a rounded butt, of a type common among Indians of the Tropical Forest; (2) a ground but not so highly polished T-shaped ax similar to the type occurring in the Andean highlands during the Inca period; and (3) a roughly cylindrical hammerstone, rounded at both ends, pecked and to some extent polished, perhaps by wear. It is not possible to tell exactly the size of the implements since the scale, which reads "reduced by 1/10," is almost surely in error. However, assuming the Tropical Forest-type celt removed from the rhea's stomach to be about the size of similar specimens I have seen, its length would be approximately 4½ inches. Using the celt as a standard, the T-shaped ax and the hammerstone would then measure about 6 inches and 5 inches in length respectively.

Although not observed by Kerr among the Chaco Indians he visited, implements of these types have been reported ethnographically from a number of tribes living in the Chaco (Métraux 1946: 293). However, it is generally stated that these Indians have acquired them by trade from tribes outside the Chaco. This instance of "thero-portation" (Heizer's term) by a rhea suggests that another source of supply for stone implements may have been available to the Indians of the Chaco. It also indicates, of course, that not all stone artifacts to be found archaeologically in the Chaco (or in other areas of South America visited by rheas, for that matter) were necessarily used or carried there by man.

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ROBERT L. CARNEIRO
American Museum of Natural History
New York, N.Y.
March, 1958

ORGANIC TEMPERING IN NORTHEAST ASIA AND ALASKA

Alaskan pottery techniques are distinguished by considerable use of a variety of organic tempering materials, in marked contrast to the rest of aboriginal North America. So pronounced a focus on the threshhold of the New World would suggest that the practice might have been borrowed from Asia. It will therefore be of interest to ascertain the status of organic tempers in northeastern Asia as compared with Alaska.

The use of animal hair for this purpose is considered to be quite typical for the middle and lower Lena valley from at least the terminal stage of the Neolithic (and possibly earlier) through the full development of the Bronze Age. It is not found in later periods (Okladnikov 1945: 32, 63-4; 1946: 28-9, 37, 47-8, 81, 89; 1950: 39, 56, 137). The trait extends eastward across the Kolyma River and into the Chukchi Peninsula on the same time horizon (Okladnikov 1955: 174; Chard 1955a). There is a curious single occurrence far to the west on the Kola Peninsula near Murmansk, associated with other Bronze Age Lena valley traits that are out of place in Europe (Okladnikov 1955: 171). On the southeast coast of the Chukchi Peninsula it is reported in 2 Old Bering Sea stage sites (Chard 1955b: 167). On the American side, in marked contrast, hair temper is relatively recent, the oldest examples dating from A.D. 1250 to 1400 on the Kobuk River (Giddings 1952: 94-5). It is also mentioned for the Tena Indians of the middle Yukon (De Laguna 1947: 141) and for the modern Alaskan Eskimo — locality unspecified (Collins 1937: 167), but is the least common organic material encountered in Alaskan pottery. Elsewhere in North America it is reported ethnographically from the Sarcee and Kutenai (Oswalt 1955: 41), but otherwise seems not to be known (J. B. Griffin, personal communication).

Oswalt has questioned whether many of the wares classified as hair-tempered may not merely show evidence of smoothing with a piece of fur, citing an example from Seward Peninsula (Oswalt 1953b: 13). It is true that in many of the Siberian instances there is only mention of the impressions of hairs on the surface of the sherd, although its use as tempering seems always to be confidently assumed. However, the presence of hair within the paste is specifically described for the Lena sites of Staryi Siktiakh (Okladnikov 1946: 89), Sangar-Khaia No. 2 (Okladnikov 1945: 63-4) and Lake Ymyiakhtakh (Okladnikov 1950: 137).

Though hair temper is not common in Alaska, the use of feathers is widespread on the same time level from Point Barrow to Bristol Bay. In some areas it plays an important role at certain periods, for example, at Kotzebue around A.D. 1350 (Van Stone 1955: 122). One wonders whether this is not a case of transferal of the technique to a new and perhaps more satisfactory medium by the recipients on the American side. The writer has encountered no references to use of this material from any Siberian sites. The earliest dates for feather temper are A.D. 1250 to 1400 on the Kobuk (Giddings 1952: 94-5), post-Punuk on St. Lawrence Island (Oswalt 1953b: 6) and around A.D. 1600 in southwestern Alaska (Oswalt 1955: 37). At half a dozen points along the west coast, and on the middle and lower Yukon, the practice is either modern, recent, or undated but probably recent (De Laguna 1947: 141-3, 228-30; Oswalt 1953b: 8-10; 1955).

Other forms of animal tempering materials are very rare in the area under consideration. There is one instance of the use of fish scales in the terminal Neolithic of the Lena (Okladnikov 1950: 137), and baleen fibers are reported at an Old Bering Sea site on the Chukchi Peninsula (Chard 1955b: 167).

The use of fiber tempering, which we assume to be of vegetable origin, is a very characteristic feature of the early wares of the northern half of Japan (Kidder 1957), which on the basis of as yet unpublished radiocarbon dates must be very early indeed. This use recalls, of course, the early fiber-tempered wares of the southeastern United States. Specifically vegetable temper is reported in one instance from the Chinese Neolithic (De Laguna 1947: 244), but must otherwise be rare here. Except for an Old Bering Sea site on the Chukchi Peninsula (Chard 1955b: 164), the use of vegetable tempering materials is unknown at any period in eastern Siberia outside of the middle and lower Lena region, where it is contemporary and associated with hair temper — sometimes in the same sherd. Grass, leaflets, and sedges have been identified within the paste (Okladnikov 1945: 63; 1946: 39-40; 1950: 137).

On the American side, grass temper is reported from the Old Bering Sea stage on St. Lawrence Island (Collins 1937: 167), in sherds of a similar ware from the Yukon arctic coast with Thule affinities (MacNeish 1956: 102-3), and in an early "Ipiutak" site in southwestern Alaska (Larsen 1950: 181). Otherwise it is relatively recent, occurring sporadically along the coast from the Kobuk to Bristol Bay (De Laguna 1947: 228-9; Oswalt 1953b: 6, 8-10; 1955: 37). Sometimes it is the only organic temper employed in these contexts, while in other cases feathers may also be utilized.

Occurrences of leaf temper in Alaska are very rare: a few 19th century lamp sherds from the Yukon Delta (Oswalt 1953a: 18) and a probably accidental instance from Kotzebue about A.D. 1550 (Giddings 1952: 94).

The use of organic tempering materials in the Lena and Kolyma valleys can be dated roughly to the period 1500 to 1000 B.C. or somewhat later. The occurrences in the Old Bering Sea stage sites serve to bridge the gap, both spatially and temporally, to the later localized proliferation in western Alaska. Northeast Asia thus has a clear chronological priority, while a historical relationship between the Lena and Alaskan techniques is definitely suggested. What role the Japanese fiber-tempered wares may have played in the ceramic history of this northern area remains a problem for the future.

Acknowledgement. The author is indebted to Wendell Oswalt for his reading of the manuscript and helpful suggestions.

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CHESTER S. CHARD
Berkeley, Calif.
May, 1958

REVIEWS

Edited by Donald Collier

Method and Theory in American Archaeology. Gordon R. Willey and Philip Phillips. University of Chicago Press, Chicago. ix+270 pp. $4.75.

In the summer of 1952, the authors began to set down their thoughts on "certain methodological and theoretical questions in American archaeology." These were first published in 2 articles in the *American Anthropologist*, the first in 1953 (Vol. 55, pp. 615-33) and the second in 1955 (Vol. 57, pp. 723-819). Phillips added to the discussion in another article published in the *Southwestern Journal of Anthropology* in 1955 (Vol. 11, pp. 246-50). All of these contributions have been revised on the basis of second thoughts by the authors and comments from professional colleagues, and the result is the volume under review.

Following a brief introduction based on the article by Phillips, the book is divided into 2 parts corresponding to the other 2 papers: Part 1, "An operational basis for culture-historical integration," and Part 2, "Historical-developmental interpretation." A considerable number of minor changes from the original versions have been made and several major ones. One of the most important is the elimination of the Preformative, originally set apart as a period intervening between the Archaic and the Formative. Cultures formerly classified therein have been moved either to Archaic or to Formative. The Formative has been redefined and is now identified "by the presence of agriculture, or any other subsistence economy of comparable effectiveness, and by the successful integration of such an economy into well-established, sedentary village life" (p. 146). By this definition, such cultures as those of the late horizon in Central California, ethnographic Northwest Coast, and Hopewell are now considered Formative. Not only has direct evidence of agriculture been eliminated as a criterion, but wild food economies are admitted if they allow "well established" sedentary life. Several changes have been made in concept definitions. For example, "horizon" and "horizon style," which were used earlier interchangeably, are now distinguished. "Full cultural tradition" was abandoned as inconsistent and "tradition" has been returned to its usual meaning in Peruvian archaeology.

Some of the innovations are likely to raise as much controversy as the original presentation. This is particularly true of the use of the term "culture," which has several meanings, most of them deviating markedly from usual anthropological usage. While lamenting the fact that "period," "culture," and "stage" are often used interchangeably in archaeological writing, the only definition Willey and Phillips offer is: "we suggest that 'culture' be used to denote maximum units on all stages up to and including the Formative, reserving the term 'civilization' for such units on the Classic and Postclassic stages" (p. 48). The authors themselves violate this by referring on other occasions to Classic and Postclassic "cultures" (pp. 54, 151). References to "both the cultural and the social aspects of the behavior that is our subject matter" (pp. 49, 57); the comment that "Archaic phases are generally richer in cultural content" (p. 52); or the statement that "it remains to be shown whether or not the unit, culture, is intelligible in the social aspect on the Archaic stage of development" (pp. 52, 57), make definition of the term "culture" even more obscure. Sometimes it means the maximum social unit, but the contrast between "cultural and social aspects" suggests it refers at other times to material remains only. In a third usage, culture is precivilization. This multiple usage without any clear-cut definition often makes the authors' theoretical discussion difficult to follow.

The current stage of archaeological method and theory is so unsystematized that almost everyone will probably be able to find statements, concepts, or assumptions in the book with which he disagrees. Rather than utilize the space allotted for review for such details, we would prefer to examine the more fundamental question: Is their kind of approach the best or most useful? Willey and Phillips deny that "rightness" is a suitable criterion for judging their developmental sequence (p. 77), but if we rule out this test, we accept all conceptual schemes as of equal value. The result would be an effective block to scientific progress. "Rightness" can be determined by relative correspondence to historical reality (as Willey and Phillips observe) and by relative clarity, precision, and objectivity with which the system can be applied. We must ask the question whether the kind of approach used by Willey and Phillips — and by most other integration-minded anthropologists in the New World — is really the best one that can be found. Before their system becomes too ingrained, it is appropriate to indicate some of the difficulties that are inherent in its use.

One of the most important qualifications of any scheme is the definability of the categories: they should be exclusive, objective, and named so as to evoke no connotations not essential to the definition. The unevenness of the archaeological record makes the task difficult, but even within its limitations some schemes can be judged as better than others. On all of these qualifications, the present historical-developmental scheme is deficient. Assignment of cultures to stages is often a question of emphasis (p. 123), and is complicated by geographical location. Willey and Phillips observe on one occasion, "the sad fact is that our definition of the Formative stage has only nominal value in peripheral situations" (p. 137). This problem arises from the fact that the stages were originally conceived in the context of the high culture area of Andean South America, where their criteria are relatively specific and a real historical-developmental sequence is involved. When these stages are stretched over the entire New World, the criteria must be correspondingly stretched, diluted, and generalized. Assignment becomes a question of emphasis rather than total content. Extraneous factors resulting from differential

diffusion, environmental influence, unique historical situations, and essentially complete independence from the nuclear American developmental stream complicate the classification. It becomes necessary to introduce concepts of "belated" or "marginal" to reconcile many such occurrences with the historical-developmental scheme.

On top of these difficulties is the mental strain of recalling that a culture assigned to the "formative" is not necessarily "formative." Willey and Phillips state: "the name 'Formative', as we use it, implies the *formation* of the New World agricultural village pattern. At the same time, it carries with it the connotation that this pattern was basic to and *formational* toward later and more advanced developments" (p. 149). However, they have decided to include in the Formative certain cultures with nonagricultural subsistence patterns because they support the high population density and associated cultural complexity characteristic of the Formative stage (p. 134). On other occasions, they classify cultures as Archaic when agriculture is definitely present, but material culture is crude, although by the implication of the term they are certainly "formative."

The second major requirement of a classificatory scheme is that it should be a tool for arriving at interpretation. The great disadvantage of the current approach is that evaluations of an historical, developmental, or environmental nature are frequently essential to making a classification of an archaeological phase. Consequently, if the results are used for making interpretations, these may already be slanted, or significant facts may be concealed. While Willey and Phillips stress the fact that their formulation is essentially descriptive, the question is also pertinent as to whether it represents the best or most useful kind of description. Is a description that equates late cultures of Central California with Chavín of Peru, or corn-raising Basketmakers of the Southwest with shellfish-eating *sambaquí* dwellers of Brazil the best, in the sense of the most useful, that we can achieve?

Another point of consideration is whether the Willey and Phillips expansion of what was originally an areal developmental scheme has advantages that are not counteracted by the damage it does to the original areal formulation. The stages (Lithic, Archaic, Formative, Classic, Postclassic) have specific temporal and historical meaning in nuclear America. In our own work, we have found these or similar stages a useful tool for making chronological and temporal identifications, as well as for sorting information and for facilitating reference to culture traits or sites. Such advantages are minimized or lost by the extension of meaning recommended by Willey and Phillips. Does the gain compensate for the loss?

The problems and dilemmas of the present position of American archaeology have been well expressed by Willey and Phillips. Since their presentation is unquestionably derived from current thinking among professional American archaeologists, no criticism of their work can be made that is not at the same time a criticism of American archaeologists in general. Willey and Phillips have made the first attempt to apply currently accepted classificatory devices on a continental (New World) scale, and they have performed the essential and perhaps thankless job of exposing the pitiful frame of theory that is concealed beneath splendid garments of myriad traits and multiple local sequences. As good scientists, American archaeologists must find a prescription that will put some meat on the bones. All American archaeologists should read this book and ponder these questions.

BETTY J. MEGGERS
CLIFFORD EVANS
Smithsonian Institution
Washington, D.C.

Abriss der Vorgeschichte. KARL J. NARR, WILLY SCHULZ-WEIDNER, CHRISTOPH VON FÜRER-HAIMENDORF, ANTHONY CHRISTIE, MAX LOEHR, KARL JETTMAR, OSWALD MENGHIN. R. Oldenbourg Verlag, Munich, 1957. vii + 266 pp., 9 charts, 22 maps. DM 32.

This book, the fifth to appear in a projected series of 9 known as *Oldenbourgs Abriss der Weltgeschichte,* abstracts prehistory on a world-wide basis. So ambitious a task would discourage most writers but the problem is solved here as a collaborative effort on the part of a 7-man team, each member of which was responsible for different segments of the globe. One need not dip into the volume deeply to discover that an amazingly complete survey has been achieved. It is safe to say that no work in English remotely approaches this volume in its scope and thoroughness.

Such attention to detail might lead one to suspect that the book is slanted for specialist use. Quite the contrary, for the reader with little more than average interest in the past will find the narrative presentation both informative and satisfying reading. For those who wish to delve deeper into the subject, and also as a key to the works consulted by the various authors, extensive bibliographic references are given at the beginning of each section.

The material is organized geographically, beginning with Europe, North Africa, and West Asia as a unit, then in succession Africa south of the Sahara, India, Indonesia, Australia, Southeast Asia, China, Japan, inner Asia, and the Americas. Most sections begin with background information ranging through such topics as geology, past climate, fossil finds, and problems of race and language. Culture types are then reviewed from early to late, on the basis of subareas within the larger units where such treatment is called for. Conventional period designators as Old (lower) and Young (upper) Paleolithic are used for all Old World areas. For the Americas where broad period labels have been infrequently applied, Menghin, who competently authors this section, sets up his own scheme. Americanists will find it strange to see their findings listed under such terms as Protolithic, Epiprotolithic, Miolithic, and so forth. But in fairness to this presentation it must be said that some framework had to be established to organize the scattered and diverse American manifestations in abstract form.

Broad syntheses inevitably suffer because of the physical limitations of a book, the inability to explore alterna-

tive explanations of problems, and the necessity to lump information. For these reasons, not all readers will agree with the authors' handling of some of the data. Yet this is greatly outweighed by the collation and the availability of so many data between the covers of a single volume.

The final pages are devoted to a series of 9 charts of culture chronology, 7 of which are devoted to the Americas, and 15 pages of excellent maps as supplements to the text. Not the least of the good points of this book is an extraordinarily complete index. Reference to subject matter in the double column format is facilitated by both a page number and a locus number, the latter placed between the 2 columns. Readability is impaired by the small type.

Works of this kind are valuable contributions to the archaeological literature and will probably disseminate the results of an excavator's findings more effectively than his technical reports. It is regrettable that efforts, as exemplified here, are so infrequent. Both the authors and the publisher are to be complimentetd on a job well done.

EMIL W. HAURY
University of Arizona
Tucson, Ariz.

Comparative Studies of North American Indians. HAROLD E. DRIVER and WILLIAM C. MASSEY. Transactions of the American Philosophical Society, n. s., Vol. 47, Part 2, Philadelphia, 1957. 292 pp., 31 figs., 164 maps. $5.00.

This study was prompted by the fact that the last attempt at integration of North American aboriginal cultural data was made nearly 20 years ago. Driver and Massey have taken advantage of additional material that has accumulated to present a new appraisal of the state of our knowledge and to apply the data to problems of explanation and interpretation. In preparing a compilation of this sort, it is obviously impossible to be exhaustive, but the authors feel that what is included constitutes a representative sample of present knowledge and is adequate for descriptive generalizations (by which they mean primarily geographical distribution) and for correlations. "North America" here refers to the area from the Arctic to the Panama-Colombia border and includes Greenland, Cuba, Hispaniola and Jamaica.

The monograph is divided into 4 major sections: subsistence, material culture, economics and social organization. Each of these is broken down into 3 to 8 subtopics Material culture, of most interest to archaeologists, includes transportation; housing and architecture; clothing and body ornamentation; crafts, fire-making and lamps; and weapons. These are further subdivided. Crafts, fire-making and lamps, for example, includes basketry, bags, and matting; knotless netting; spindle whorl; weaving frames and looms; pottery making; skin dressing; metallurgy; and fire-making and oil lamps. From ½ to 2 pages of text discussion is devoted to each of these topics, and distributional data are presented on one or more maps. For pottery-making, there are maps showing the occurrence of the craft in general, techniques of pottery making and sexual division of labor in pottery making. Interestingly, methods of pottery decoration, of great importance to the archaeologist, are not discussed.

The presentation of a cross section of American Indian culture is complicated by the considerable time range represented by available data. Even if archaeological sources are excluded, the ethnographic sources span almost 500 years. In order to achieve a maximum of comparability, data were selected to give a picture of aboriginal culture at the time of European contact. Since this contact took place in the 16th century in some places and the 19th century in others, the maps do not show the distribution of any trait at a single time period. In some cases where a trait was present archaeologically but absent ethnographically, this information was included, but extensive use of archaeological data is ruled out by the definition of the time period to be considered.

Although little use is made of archaeological data, the report is of interest to archaeologists for its theoretical position, particularly relating to environmental influence on culture. The authors feel that "a theory of culture which ignores or is unable to account for the geographical distributions presented here falls short of the mark" (p. 165). They reaffirm that culture areas and natural vegetation areas show striking correlation, and note that certain specific aspects of culture not obviously environment-related are in fact closely linked with environment. Thus, "environment . . . can be a partial determiner of religion and ceremony" (p. 259). The influence of environment is considered significant in explaining the distribution of house materials (p. 305), slings as weapons (p. 357) and various forms of clubs (p. 359). The authors accept the possibility that trans-Pacific contact took place in both directions, but feel that it had little influence on aboriginal development.

As far as cultural laws are concerned, Driver and Massey believe that "the only hope for establishing order in cultural materials is to seek out the partial degree of order which the concept of correlation recognizes" (p. 421). They use this method to arrive at statistically valid conclusions about the causal relationships in the field of social organization in the last chapter, which is the only one devoted to interpretation. While the major conclusions confirm those reached by Murdock in his book, *Social Structure*, the authors feel the data show that changes in social organization can be produced by contact between groups as well as by an evolutionary process. They state, however, that to produce such changes contact must be "intensive, prolonged, involve the exchange of personnel as in intermarriage, and perhaps even include the transfer of some economic features" (p. 438). The question can be raised as to whether change resulting from this kind of contact is really different from evolution, which is at bottom a form of cultural readjustment.

Although such interpretations will interest only the most theoretically minded archaeologist, almost everyone will find the 164 maps valuable for putting cultural traits

into a distributional frame of reference or as a starting point for detailed comparative analysis. We may hope that this report will stimulate a greater interest among ethnologists in collecting the kind of ethnographic data that archaeologists can use.

BETTY J. MEGGERS
Smithsonian Institution
Washington, D.C.

Archaeology and Society. Reconstructing the Prehistoric Past. 2nd edition, revised. GRAHAME CLARK. Harvard University Press, Cambridge, 1957. 272 pp., frontis., 52 figs., 24 pls., endpaper map. $5.00.

This is a modified and in part rewritten edition of an extremely interesting and readable book on archaeological problems in the Old World. Its concern with the general aims and methods of prehistoric archaeology make it of broad anthropological interest, although illustrations are drawn nearly exclusively from European cultures of Late and Postglacial (Mesolithic) times and the Bronze and Iron Ages. The organization of the 8 chapters, as well as the plates and text figures, remain largely unchanged from the previous revised (1947) edition; however, several new line drawings and diagrams have been added. The reviewer still finds of greatest interest the chapters on survival of archaeological evidence under various circumstances, and the extended discussion of the problem of reconstructing the life of prehistoric peoples (a matter dealt with in detail in Clark's *Prehistoric Europe: The Economic Basis*).

This book will prove of particular usefulness in introductory courses in general anthropology as well as archaeology. It cannot be too strongly recommended also for the interested colleague in another discipline as well as the educated lay reader.

F. CLARK HOWELL
University of Chicago
Chicago, Ill.

Skeletal Age Changes in Young American Males, Analyzed from the Standpoint of Age Identification. THOMAS W. MCKERN and T. D. STEWART. Technical Report EP-45, Environmental Protection Research Division, Quartermaster Research and Development Center, U.S. Army, Natick, 1957. viii + 179 pp., 87 figs., 52 tables.

This technical report represents a major step forward in the determination of age from skeletal remains. It is the clearest and most comprehensive study available, and will be of the greatest value to anyone who is concerned with skeletal maturation. The report is based on the study of the skeletons of 375 identified soldiers who died in Korea and whose remains were later returned to this country. The age range is 17 through 50, with the greatest concentration in the years 18-23. Methods of recording, description, and analysis are carefully described. The report deals at length with suture closure, eruption of the third molars, epiphyseal union in the limbs, aging on the innominate bone with a new system of describing age changes in the pubic symphysis. There are sections on the clavicle, vertebrae, scapula, sternum, sacrum, and ribs. Finally, a method of scoring the maturity of the skeleton is given and the predicted ages checked against known age. A table of least mature and most mature skeletons at each age is included, and there is an excellent bibliography. The archaeologist will find this report far more useful than any other account of skeletal age changes.

McKern and Stewart demonstrate that the age changes in the skeleton are an exceedingly orderly process. They reduce the 9 features which Todd described in the aging of the pubic symphysis to 3 and give the order for each of these. The descriptions of aging of the pubic bone, ischium, iliac crest, clavicle, vertebrae, and ribs represent very significant advances over accounts now available. Each suture, epiphysis, or surface is rated in 5 maturational stages. The 52 tables give the age and variation for each stage, and estimates of age based on maturational scores. The scores are obtained by adding the maturational ratings according to rules clearly presented in the report. The results demonstrate a far wider normal range of variation in the relation of skeletal maturation and chronological age than is now recognized. Variations which have been considered anomalous are found to be normal and common. Perhaps the results on suture closure represent the greatest departure from the traditional point of view. McKern and Stewart conclude, "So erratic is the onset and progress of closure that an adequate series will provide just about any pattern at any age level." Variation must be greater still in archaeological collections in which interpretation is complicated by sex, race, and a greater diversity of ages.

The detailed description of age changes given in this report should make it possible to see any individual skeleton in its maturational position during the changes which take place between 17 and 30 years. Ages younger than this can be estimated from the earliest epiphyses and the erupting teeth. Clearly, in view of the McKern and Stewart critique of previous investigations, the description of later age changes must be done again. But these older ages are well represented in the Todd and Terry collections, and it is greatly to be hoped that the authors of this report (or qualified investigators who have standardized their technique with Stewart's) will complete the study of the older ages. So it is not unreasonable to think that the placement of a given skeleton in its position in the aging process can be done more accurately than ever before and that the descriptive techniques and collections are available to extend the range of the accurate observations. However, there seems no reason to suppose that further study of aging will increase the accuracy of estimate of chronological age. Human beings do age at different rates, and the maturational age of an individual and chronological age become less and less closely related as time goes on. The anthropologist can save himself a lot of time by not trying to make more precise estimates of age than are warranted by the nature of the

material. The identification expert will have to be more cautious in his claims in the future. From the standpoint of the archaeologist, this makes little difference because aided by better descriptions of aging than we have ever had before, he can describe the maturational profile of his populations without being concerned with precise chronological age.

S. L. WASHBURN
University of California
Berkeley, Calif.

Archeological Investigations at the Mouth of the Amazon. BETTY J. MEGGERS and CLIFFORD EVANS. Bureau of American Ethnology, Bulletin 167, Smithsonian Institution, Washington, 1957. xxviii+664 pp., 206 figs., 112 pls., 73 tables. $5.00.

This massive volume constitutes the first full scale report on survey and excavations in one of the most crucial regions in South America: the mouth of the Amazon River. Between 1948 and 1949 the authors spent one year in the Brazilian Territory of Amapá and the adjacent islands of Marajó, Mexiana, and Caviana, where they carried out a long series of field excavations, the results of which are described in this book.

The report is organized with clarity and logic. After a short introduction on the planning of the expedition, its itinerary, and the specific problems of field technique, there follows a discussion of the general concept of Tropical Forest culture which anticipates in part the authors' ample but careful use of ethnographic data in the interpretation of the archaeological evidence. After these introductory statements, the major portion of the volume — more than 500 pages — is dedicated to the description of actual fieldwork and its results. The treatment is regional, covering first the mainland Territory of Amapá, and then the islands, with special emphasis on Marajó, giving full data on geographical features, site characteristics, and artifacts recovered. The 2 concluding chapters deal with the chronology and ethnography of postconquest developments, and with the wider significance of the prehistoric culture sequence. An appendix of 52 tables traces the frequency of general and specific ceramic traits by phases and individual sites. The report is abundantly illustrated with excellent laboratory and field photographs, line drawings, and maps.

The outstanding value of the descriptive section of this report lies in the careful treatment given to the ceramic materials which are analyzed with great technical skill and precision. Pottery types are established and described with clarity and detail, and the many accompanying illustrations of vessel shapes, rim sections, and decorative elements are particularly valuable in this part of the report. The chronological sequence is based upon stratigraphy, seriation, and crossdating. No cultural continuity of marked time depth was observed, but rather a succession of distinct cultures which seem to have originated in other regions of the continent, each being displaced or absorbed by new invaders who arrived in the Amazon delta. No preceramic sites were discovered, nor any cultures which might be identified with an initial stage in Tropical Forest developments, but on Marajó the earliest phase (Ananatuba) represents already a well defined form of adaptation in terms of the ethnographical definition of the Tropical Forest pattern. The Mangueiras phase which follows appears to have been in part contemporaneous with the Ananatuba, but finally dominated it, being replaced in turn by the Formiga phase, a third complex which, like the 2 preceding ones, appears fully developed in the deltaic region. Approximately during the Mangueiras phase there appears the Acauan phase which during a short time span occupied Mexiana Island. On Marajó there follows now the Marajoara phase, a culture of Circum-Caribbean or Sub-Andean characteristics which, at the peak of its development at its appearance, declines steadily afterwards until its deculturation reaches the Tropical Forest level of its predecessors. At the time of this decline the Aruã phase makes its appearance in the Territory of Amapá, from which it is displaced — and then followed — to the islands, by the invasion of the bearers of the Mazagão-Aristé phase. Shortly afterwards, there appear European trade objects in Aruã phase contexts. The over-all time range is perhaps 1500 years, and even the earliest phase seems to fall within the Christian era.

With the exception of the Aruã phase the origins of which can be traced to the north, the authors believe that all other culture complexes arrived fully developed and in successive migrations proceeding from the northwestern regions of South America, more specifically from Colombia and northern Ecuador. This hypothesis is based upon the observations that local ancestral phases are lacking, that sporadic finds along the Amazon River seem to correspond to the phases identified in the delta, and that there exist many striking resemblances in concept and detail between Colombian-Ecuadorean cultures and those defined at the mouth of the Amazon. Among others the authors cite such elements as excision, hollow rims, annular bases, pottery stools and stands, secondary urn burial, and so forth.

To the Colombian archaeologist this theory is both tempting and tantalizing. There can be no doubt that these resemblances do exist and that they are highly significant, but at the same time one must admit that the archaeology of the Colombian regions through which these cultures might have diffused toward the Amazon, is practically unknown. However, judging from sporadic and largely unpublished evidence, this reviewer, at least, believes that such diffusional trends in this direction are indeed quite likely to have existed, and that systematic research on the upper Magdalena River and the rivers running east from the Cordillera Oriental would probably prove Meggers and Evans right. Forthcoming and future research along the Amazon will certainly contribute much to the solution of this problem, but it is obvious that the main points must be answered on Colombian territory.

This is a book of high technical quality and, in many ways, a model of clear presentation, painstaking descrip-

tion, and sound analysis. But quite apart from its solid factual reporting, it contains also some challenging thoughts in a wider sense. The decline of the Marajoara phase, originally a complex of Circum-Caribbean type, is attributed by the authors to the "leveling effect of the tropical forest environment" (p. 605), and the discussion of this phenomenon leads them to a thought-provoking evaluation of Steward's theories, and of the balance between agricultural technology and the potentialities of the physical environment. The authors' acute awareness of ecological factors, of environmental limitations on culture growth and content under tropical forest conditions, and of the necessity of using ethnographic data in the interpretation of the prehistoric records, adds much breadth and scope to their archaeological evidence. That the archaeologist "must make it possible to trace types of culture and not just types of pottery backward through time" (p. 24) is also a refreshing reminder. In doing just that the authors have set a high standard in intelligent interpretation of their evidence, and have done a splendid job in laying the foundations of systematic Amazonian archaeology.

G. REICHEL-DOLMATOFF
Instituto Colombiano de Antropología
Cartagena, Colombia

A Chancay-Style Grave at Zapallan, Peru. An Analysis of its Textiles, Pottery, and other Furnishings. S. K. LOTHROP and JOY MAHLER. Papers of the Peabody Museum, Harvard University, Vol. 50, No. 1, Cambridge, 1957. viii + 38 pp., 10 figs., 17 pls., 9 tables. $2.50.

Zapallan (or Zapallar) is a settlement and cemetery site located near the Pan-American Highway between Lima and Ancón on the northwestern rim of the Chillón Valley on the central coast of Peru. While surface collecting on this site in 1943, Lothrop noticed 2 pot hunters who had just reached the level of funeral furnishings of a grave. He was thus able to observe the removal of the grave gods and to purchase them before they could be dispersed.

This grave (Grave Y) was of late Ancón period. It contained a mummy bundle fashioned to represent a woman and more than 300 items, including 16 pottery vessels representative of the following types: White and Black on Red, Black and Red on White, Black on White, Plain White and Plain Red. The number of the vesssels of each type is not indicated. A loom, 22 textiles, some complete, some fragmentary, 2 workbaskets and associated items and more than 200 reeds or bundles of reeds decoratively wrapped in multicolored yarns were also recovered.

The authors do not confine themselves to an analysis of this particular grave. They also discuss stylistically comparable material collected by the senior author and present certain comments of general interest for this area. Appendix I is a list of the Peabody Museum catalogue numbers of the specimens illustrated or discussed in the text. Photographs of 32 vessels (3 of which are from Grave Y) provide a useful catalogue of examples of late central coast ceramics. Appendix II is a description of 3 cloth dolls from Cajamarquilla included because they carry miniature representations of yarn-wrapped reeds similar to those found in Grave Y. Appendix III is a note by Barbara Lawrence on 2 dogs found in Grave Y. Appendix IV is an analysis by William J. Young of 8 yarn samples identifying the types of dyes and mordants. The textiles and associated items are particularly well illustrated.

Of general interest is a critique of the latest part of the Ancón pottery sequence. Lothrop and Mahler state that at a certain number of sites "overlapping and contemporaneity of certain [Ancón] pottery types is as well established as their supposed sequence" (p. 12) and that the stylistic dating for the area therefore needs to be revised. The authors point out that Uhle's excavations in the Chancay Valley included 3 sites with a mixture of Black on White (Late Ancón II) and Three Color Geometric (Late Ancón I), that Willey's excavation of 18 graves at Ancón in 1942 included 5 graves with Three Color Geometric (Late Ancón I) associated with Four Color Epigonal or Red Pressed (both Middle Ancón II), and 2 graves with Four Color Epigonal (Middle Ancón II) and Black on White or Plain White (both Late Ancón II). Grave Y itself considered to be representative of Zapallan as a whole because of the similarity of its contents with the surface material, includes types of pottery color decoration which span several periods in Strong's original Ancón pottery frequency table (1925: 160, Table I, The Uhle Pottery Collections from Ancón. *Univ. of Calif. Pubs. in Amer. Arch. and Ethnol.*, Vol. 21, No. 4).

The overlapping of types had already been pointed out in Strong's original report. In general, each trait comes into slight use in one period, gradually increases to the height of its popularity and then fades out. (Strong 1925: 165). The chronological ordering of Uhle's collections as well as Willey's additional work were based on the recognition of the contrasting percentile distribution of 40 different ceramic traits and not on presence or absence of a few color decoration traits. For when considered alone these traits have a limited temporal diagnostic value.

It is conceivable that a certain number of the "mixed" graves cited by Lothrop and Mahler might reflect the local preferences of decorative techniques or perhaps disturbances of graves. But if one considers that they constitute a minority, it would not seem fruitful to contest, at least on these grounds, the usefulness of the established chronological ordering of late Ancón type graves. The correlation of the Ancón sequence with other coastal Peruvian sites certainly needs clarification, and we agree that further work should be done.

The authors devote a great part of this short paper to the fabrics, weaving equipment, and yarn-wrapped reeds found in Grave Y. Emphasis is especially placed on the spinning techniques which are compared with those

demonstrated by textile fragments collected by the senior author at a certain number of central coastal sites. The importance of the number of textile items recovered from Grave Y and their analysis will make this paper especially useful for students of Peruvian textiles.

Jacques Bordaz
Columbia University
New York, N.Y.

Pre-Columbian Art. S. K. Lothrop, W. F. Foshag, and Joy Mahler. Phaidon Press, distributed by Garden City Books, New York, 1957. 286 pp., frontis., 31 figs., 162 pls., 1 chart, 2 maps. $30.00.

Robert Woods Bliss has been for many years an ardent collector of works of art, and this publication illustrates 400 pieces from Nuclear America purchased by him in Europe and in the United States. The collection is at present on display in the National Gallery in Washington. The book is much more than a catalog of objects. The quality of its reproductions alone is something quite extraordinary. Of the 240 figures which compose the plates, 168 are in full color, and of a size that permits full appreciation of nuances of form and texture. The photography by Nickolas Muray is superb. For the purposes of historical information such a presentation would be unduly extravagant, especially since there is almost no archaeological record accompanying the pieces, but this book was not meant for archaeologists; its aim is no less than to transmit the aesthetic qualities of the arts for the sheer sake of their enjoyment, and its achievement in this respect has seldom been equalled.

The collection contains objects from Middle America, Central America and the Andean area in comparable numbers, and covers a wide variety of materials, techniques, and styles. The collections of Peruvian textiles, of Panamanian and Colombian gold, and of Mexican jades are particularly fine. Ceramics are somewhat less well represented, and sculpture is limited to pieces of small size, although there are a number of notable pieces in the Classic style of Veracruz.

In a collection of such scope, acquired by purchase, there are bound to be pieces that will be challenged by some scholars as apocryphal. For example, recently there has been considerable controversy over the style of certain Maya figurines said to come from Campeche. Many are skillfully restored, and it would be difficult to get agreement on the authenticity of particular pieces. One can only say that the selections in this volume have been made with care and with expert advice, and if there are errors they are not of the obvious sort. In several cases, where restoration is known to have been made, the fact is noted in the text. The descriptions of the pieces, which follow the plates, are well worth perusal, for they show the author's intimate knowledge of the archaeological background of the material, and contain a good deal of information and intelligent comment. It is a pity, however, that only in rare cases is reference made to the history of the pieces and no previous publications are cited, although some of the specimens are well known. The disadvantage of this is obvious. In one case, the reviewer feels that a sculptured piece, Number 102, has been wrongly assigned to Structure 26 at Copan, and that it very probably comes from Structure 22. A reference to its earlier designation would make it easier to check on what is actually known about the piece. One can only hope that records have been preserved in the catalog and that they will some day be made available. It is understandable that the publication at present of the full history of the pieces might be embarrassing to certain persons, but this does not apply to references to publications, which are in any case a matter of public record. That art lovers are not interested in historical accuracy is an unwarranted assumption implicit in the omission of such material.

The chapter on "Cultures and Styles" by Lothrop is an admirably condensed account of what is known about the background of each artistic style. This text was written in 1954 and has not been revised, so that it contains a number of statements that currently would be questioned. Although it sacrifices precision to clarity and conciseness, however, it remains an excellent introduction to the plates. It is unfortunate that the text illustrations, though adequate, are so inferior to the plates that one is very conscious of their shortcomings.

The following 3 sections: "Mineralogical Attributions," by Foshag; "Textiles," by Mahler; and "New World Metallurgy" by Lothrop will be of particular interest to archaeologists and are well worth their attention. They contain a summary of technical information, which elsewhere occurs only in scattered publications and is not easy to come by. They are also particularly helpful in suggesting a precise terminology for materials and techniques, with which a general archaeologist may not be familiar. These 3 sections and the magnificent plates make this a volume of such worth that its minor lapses in scholarship may well be disregarded.

Tatiana Proskouriakoff
Carnegie Institution of
Washington
Cambridge, Mass.

Indian Art of Mexico and Central America. Miguel Covarrubias. Alfred A. Knopf, New York, 1957. xvi + 360 + xvii pp., 146 figs., 64 pls., 12 color pls., map. $17.50.

Covarrubias died before he saw this volume in print. It is the second volume of a contemplated trilogy. *The Eagle, the Jaguar and the Serpent* was the first; a final volume on South America remains unfinished.

This volume is a careful and scholarly piece of work. As a book on the prehistoric art of Mesoamerica it cannot be excelled. The text, clear and well written, systematically surveys the Preclassic, Classic, and Historical (Postclassic) cultures and their interrelationships. The area covered is mainly Mexico, and the reader will find the Central American art promised in the title to be

limited to Guatemala and to Copan in Honduras. Notwithstanding the fact that there are many well known specimens illustrated, the author has introduced us to a whole new series of pieces in private and museum collections. With very few exceptions the source of specimens is given. Some errors of specimen provenience are listed later in this review. The numerous drawings (all by Covarrubias) are not only technically superlative, but can be trusted as showing detail with accuracy — there is no artistic license here employed whereby more is portrayed than can actually be discerned on the pieces themselves. The index, an important feature of such a book which will be much used for reference, is accurate and full.

In the wide-ranging survey of sites and cultures discussed within the standard threefold classification mentioned above, one encounters statements or opinions which may seem either to be based upon incomplete evidence, and therefore premature, or simply wrong. Any person of Covarrubias' knowledge and experience might be expected to have opinions — these are plentiful, but can always be distinguished from those of others. One such opinion is that there is evidenced at Tlatilco an Olmec elite dominating a Zacatenco peasantry. Although Olmec (La Venta period) influence does occur in Tlatilco, Covarrubias goes too far in ascribing traits to an Olmec authorship. In addition to Olmec and Zacatenco traits there is a *tertium quid* at Tlatilco, a suite of ceramic traits which is distinctive. Rather than discuss details here, those readers interested can await Piña Chan's forthcoming full report on Tlatilco and the report on 1955 excavations at the La Venta site (*Bureau of Amer. Ethnol., Bull.* 170). The opening of the Classic in the Valley of Mexico is attributed to the influence of the Gulf Lowland Olmec — a theory quite unsupported by known facts but one long argued by Covarrubias. The attribution to "a single style" of the rock carvings at Chalcatcingo (Morelos), San Isidro Piedra Parada (Guatemala) and Chalchuapa (El Salvador) is incorrect — these are all clearly Olmec-inspired, and several styles, presumably chronologically significant, are represented. Covarrubias comes very near the point of proposing Olmec as a horizon style — and for this there is surely not sufficient evidence at present. The badly disfigured sandstone "sarcophagus" from La Venta referred to by Covarrubias as "reported destroyed" seems to imply lack of proper responsibility for preservation by the excavators and this can be flatly said not to be the case — a seemingly minor matter but important in that the phrase might be taken as a reflection on American archaeologists. The sarcophagus was made of the loosely bound local sandstone, was badly eroded and cracked when found and was beyond salvage in its disintegrated condition at discovery. That Olmec is the "mother culture" of Mesoamerican civilization (p. 83), that the La Venta site is a *late* Olmec florescence (p. 77), and that the Olmec hearth is in Guerrero and Oaxaca (p. 110) are particular theories of Covarrubias — the evidence may also be read to indicate that La Venta is among the earliest known Olmec sites and that the Olmec culture hearth lay in the Veracruz-Tabasco coastal lowland area. The guess that the Olmec florescence dates from 1000 to 500 B.C. is supported by recent La Venta site radiocarbon dates (*Science*, Vol. 126, pp. 72-3, 1957). The conception of the sudden collapse of the Preclassic cultures and the sudden rise of the Classic phase is an over-simplification — the evidence can be interpreted as a transitional process proceeding at variable rates. The mystery of the supposed absence of Teotihuacan I occupation at Teotihuacan (p. 127) has recently been illuminated by Millon's discoveries (reported in *Boletín del Centro de Investigaciones Antropológicas de México*, No. 4, 1957). Another problem (p. 130) now solved (by the investigations of Carmen Cook de Leonard) is the localization of the manufacture of Thin Orange pottery at Izcaquistla, Puebla. The suggestion (pp. 166, 223) that the Maya art style derives from the transition period between Preclassic to Classic times through influences from the Gulf Coast may or may not be true — the idea is interesting and Covarrubias' opinion based upon his stylistic sensitivity may be worth further examination. It is fairly obvious that the source of part of this idea comes from Proskouriakoff's (1950, *Carnegie Inst. Wash. Pub.* 593) study of Classic Maya sculpture. The new Noguera-Luis Covarrubias developmental classification of figurine types, derived from the Vaillant typology, appears in Figure 8. A fuller version will appear in Piña Chan's Tlatilco report now in press.

A number of errors must be pointed out. These are in the illustrations, and had Covarrubias lived to read final printer's proof he would surely have corrected these. The publisher should have had the captions checked by someone in the absence of the author. Figure 108, said to be the Palenque sarcophagus cover (shown correctly in Pl. LI), is actually Stela 1 from Bonampak. Figure 19, *right*, shown as a complete piece, is Drucker's reconstruction based upon 2 fragments — size and layout are hypothetical and the piece should be regarded as such. Plate I legends for the 2 specimens on *left* are reversed. The sculpture shown in Plate XIII *lower* was recovered by Drucker and the present reviewer at La Venta in 1955. It is not from Guatemala and is now on exhibit in the Museo Nacional in Mexico City. Plate XV *lower left* is not from La Venta as stated in the legend but is from a site, presumably Olmec, near Potrero Nuevo on the Río Chiquito region, and the "mosaic mask" (at right) is the reconstruction accurately assembled by Eduardo Contreras which until recently was in the patio of the Museo Nacional in Mexico City. (A duplicate exposed by Wedel in 1943 at La Venta is still *in situ*). This "mask," incidentally, together with nearly all of the monuments at the La Venta site have recently been removed to the "Parque Olmeca" at Villahermosa. Plate XVI *lower left* is inverted. There seems no warrant for labeling the carved stone figurines in Plate XVIII as Olmec. A replica of the remarkable sculpture shown in Plate XIX is now on exhibit in the Museo Nacional. The legend for Plate XXVIII is badly confused (the text, pp. 131, 133 is correct); the lefthand figure on this plate is the idol of Coatlichan. The 2 sculptures in Plate LX are attributed to Teotihuacan rather than Tenochtitlan, an error not

likely to have been made by the author. Both pieces shown in Plate LXII have recently been published by Lothrop as belonging to the Bliss collection.

Covarrubias' book shows an extraordinarily complete knowledge of the archaeological cultures of Mexico. Most of this information is presented in a descriptive and chronological context which is quite acceptable. The author's opinions he is entitled to, and specialists on one area or period will support or decry these. Taken as a whole the author has steered the middle course of conformity to conclusions that are generally agreed upon. The insistence on Olmec as the *cultura madre* of Mesoamerica probably flows from his obvious special interest and hyper-enthusiasm over the sculptured art of this culture — he may be partly correct in this, but his conception of what is Olmec is much broader than that which can be derived from pieces known to be Olmec. In sum, the book is stimulating, and the most notable presentation of excellent figures and photographs of Mesoamerican art published to date. Only Covarrubias could have written this book, and it is a fully adequate last work of a man who was at once a teacher, author, archaeologist, painter, art historian, and likeable human being.

ROBERT F. HEIZER
University of California
Berkeley, Calif.

The Sixteenth-Century Pokom-Maya: A Documentary Analysis of Social Structure and Archaeological Setting. S. W. MILES. Transactions of the American Philosophical Society, n. s., Vol. 47, Pt. 4, Philadelphia, 1957. Pp. 735-81, 4 figs. $2.00.

This study presents certain aspects of the ethnology of the Pokoman, a Maya people of highland Guatemala, at the time of Spanish contact and immediately subsequent to it. The majority of the data apply to social and political structure; this material, constituting Part II, is the most complete and the best organized. That this is so is no doubt largely due to the orientation of many of the primary sources from which the author has painstakingly extracted her facts to fit into the mosaic of reconstruction: town record books, census reports, and mission reports which were particularly concerned with the composition and organization of the local population. Miss Miles has also used letters and other writings of direct observers and early historians. These and the population records are conventional documentary sources and I cannot agree with the author that they "have been infrequently . . . employed in ethnographic research," although they have sometimes been ignored where they might have been successfully involved. Far less commonly used source material, which the author has drawn on with skill and success to bring a unique dimension to her study, is the Spanish-Maya dictionaries and grammars prepared by the mission priests of the 16th, 17th, and 18th centuries. She is quite correct in her contention that native language dictionaries have been largely overlooked as primary sources for ethnohistory. Her study is an excellent example for this area, as is R. H. Thompson's more recent "Modern Yucatecan Maya Pottery Making" (*Mems. of the Soc. for Am. Arch.*, No. 15), of the store of data available to the prehistorian or ethnologist willing and able to handle linguistic material. Miles's evaluation of the dictionary sources will be of value to scholars who wish to utilize them for other investigations.

Traditions and legends, calendrical and religious information, and archaeological evidence are brought to bear in Part I on reconstruction of Pokoman history. After defining the Pokom linguistic area and relationships, the author discusses the origin and precontact location of the Pokoman and particularly their relationship to the Nahuat-speaking Pipil among whom the Pokoman are interspersed in 3 enclaves (or vice versa). She suggests that the Pokoman and Pipil intermixed in El Salvador and southeast Guatemala in preconquest time and that "the 'Pipil' of the middle Montagua Valley would be actually bilingual Pokoman-Pipil with the possible addition of resettled Mexican auxiliaries." Documentary material on the 16th century Pokoman calendar is slight. However, using the fragments extant, an undated manuscript calendar in Kekchi, 20th century Pokom terms, other highland calendars (Cakchiquel, Quiché, and Ixil), and the lowland Yucatec data, the author has made a comparative study and partially reconstructed the 16th century Pokoman calendar. She finds the closest correspondence with the Yucatecan calendar with its Classic Maya innovations rather than with the highland forms which represent the Preclassic type. Students of the calendar should find this exercise in reconstruction interesting and profitable. I am unable to judge whether the argument is firmly founded; it is, however, convincing. Since there are little data on gods and religious practices among the contact Pokoman, this section in the historical description is, of necessity, sketchy. Lowland affinities are again suggested, as with the calendar.

Miles has found the usual difficulty in correlating archaeological sites and ethnological groups. She has conservatively delimited Pokoman territory and suggested possible paths of movement. This section on archaeological background is valuable for questions raised, not answered, but the author is not entirely responsible for this situation. The subtitle of the study promises more in this area than the author can provide.

I hope that Miles will follow up this excellent initial presentation of Highland Maya kinship and political structure which comprises Part II with the full areal reconstruction she indicates would be possible from intensive study of documents. Such material is invaluable to the prehistorian of the area who as a social scientist wants to go beyond the scattered material remains to the organizational base of the complex civilization on which so much intensive research has been focused for so long. The data on settlement patterns and political structure in the study at hand are particularly valuable. The author defines 3 types of permanent population centers — town, hamlet, and pajayu — and suggests a fourth, the open-county village. Where possible she ties these types in

with archaeological evidence. In discussing political organization she interjects a note of caution, that it is difficult to assess the extent to which Spanish concepts are involved in the documentary picture of the Maya state.

The Sixteenth-Century Pokom-Maya is a careful study, but somewhat uneven due to the nature of the material. Since many diverse and complicated topics are taken up, an over-all summary would have been a useful addition.

NATHALIE F. S. WOODBURY
Barnard College
New York, N.Y.

Limnological Studies in Middle America, with a Chapter on Aztec Limnology. EDWARD S. DEEVEY, JR. Transactions of the Connecticut Academy of Arts and Sciences, Vol. 39, Yale University Press, New Haven, 1957. Pp. 213-328, 17 figs., 4 pls., tables. $2.75.

Limnology is the scientific study of fresh-water lakes and ponds and has to do with their physical, chemical, and biological features. Observations of this kind on lakes in Guatemala, El Salvador, central and northern Mexico, and southern Texas comprise about ⅓ of this monograph and have little direct interest to archaeology. They are materials that were gathered to serve as background to Deevey's primary interest, the paleolimnology of the area — the lake-bottom sedimentation, pollen history, and general problems of the Pleistocene and Recent periods. He has published one article on the subject in this journal (Vol. 10, 1944).

Gathered also as background to these studies, Deevey presents a survey of materials and observations on what he calls Aztec limnology, the knowledge and use of lake phenomena by the Aztec and other peoples of Middle America. The chronicles and codices are searched for their indications of the extent and nature of this knowledge, limited in the chronicles, it is averred, by the fact that the Spaniards were unacquainted with lakes and had little interest in them or understanding of their importance to the native cultures of the Valley of Mexico. There are discussions of the various ways in which the lake fauna was used, of salt making, and of the Aztec's control and use of the lake water. There are also short reviews of the importance of lakes in Michoacán and in Guatemala and El Salvador as seen in the historical accounts.

This is in no sense an exhaustive study of the importance of lakes to the cultures of Middle America. It is, however, an instructive survey that points up a special kind of adaptation in the Valley of Mexico. As Deevey says: "Lake *villages* are known all over the world but lake cities are much less usual."

GORDON F. EKHOLM
American Museum of Natural History
New York, N.Y.

Ancient Man in North America. 4th edition, revised. H. M. WORMINGTON. Denver Museum of Natural History, Popular Series, No. 4, Denver, 1957. xviii+322 pp., 72 figs. $3.65 paper, $5.25 cloth.

During the past 20 years there has been a tremendous increase in the number of investigations pertaining to ancient man in the New World. This increased interest is, perhaps, nowhere better illustrated than in the book under review. The first edition, published in 1939, contained 80 pages and a fairly complete bibliography of 92 items. The present edition is almost 4 times this gross size and there are 586 references in the bibliography. In part this growth reflects the widespread interest which has developed for American archaeology in general, but the subject of early man has benefited from this interest to an unusual degree. Many of the major advances in this area can be attributed to the development in scientific techniques which are directly applicable to the peculiar problems of this field. Fluorine and uranium analyses, radiocarbon dating, and pollen identification have become standard tools of the early man specialist. In addition to these important, but often complex, technological innovations, the number of localities reported where human artifacts have been found associated with extinct animals has grown to a sizeable list. As a result, there is no longer any question but that man was present in North America at the close of the Pleistocene, but, at the same time, it has become almost impossible for anyone but the extreme specialist to keep track of the mass of accumulated data on this subject. There is, consequently, a great need for compilation and summary of the pertinent facts. Miss Wormington's book fulfills this need most satisfactorily, particularly as a convenient inventory of the known sites.

This book is written clearly, and for the most part, in non-technical terms, but it is not a "popularized" account of ancient man. It is designed primarly for the interested amateur, but anyone concerned with North American archaeology will find it a valuable reference tool. The material is presented in 6 chapters, plus an appendix illustrating and defining certain projectile and knife types, a glossary, and an index. In the introductory section (20 pages), Wormington defines her problem, both geographically and temporally, briefly outlines the basic techniques for dating, and discusses the geology of the Pleistocene. The bulk of the report (204 pages) is concerned with an encyclopedic presentation of the data from the numerous localities from which "early man" material has been reported. Three major traditions are defined: Paleoeastern (Sandia, Clovis, Folsom, Plainview, Scottsbluff, Eden, and so forth), Paleowestern (Gypsum, Pinto, Cochise, San Jose, and so forth), and Paleonorthern (Denbigh and its relatives in Alaska and Northern Canada). This classification seems reasonable, although the evidence for the antiquity of a distinctive Paleonorthern tradition is less than satisfactory. The data from the numerous sites are accurately and concisely presented, and where several alternate interpretations are possible from the evidence, the conflicting points are sharply outlined, and frequently the author voices her opinion on the subject. This will-

ingness to record her own views on points in dispute is much more evident in this edition than in its predecessors, and it greatly increases the value of this work, for Wormington is rightfully regarded as one of the outstanding authorities on the subject of early man in the New World. However, this reviewer was greatly disappointed that she was unable to consider the problem of the so-called Eastern Archaic cultures and the recent suggestions of considerable antiquity for this material. This is perhaps one of the most interesting problems now developing and there may be sufficient evidence already available to warrant defining a fourth tradition to include the early Archaic.

Chapter 5 is concerned with the dozen or so human skeletons for which there is some evidence of considerable antiquity. It is evident from her discussion that the evidence is really adequate in only 3 or 4 of these cases and we still know very little about the physical appearance of the first Americans.

The report concludes with a brief (11 pages) discussion of the peopling of North America. In the opinion of this reviewer, a great deal more should have been done to synthesize the data in the preceeding sections into a generalized picture of early cultural development in the New World. Such a synthesis is greatly needed, and Wormington would have performed a great service had she undertaken the task.

FRED WENDORF
Laboratory of
Anthropology
Santa Fe

The Cultivation and Weaving of Cotton in the Prehistoric Southwestern United States. KATE PECK KENT. Transactions of the American Philosophical Society, n. s., Vol. 47, Part 3, Philadelphia, 1957. Pp. 457-732, 143 figs., 13 maps, 14 tables, 23 charts. $4.00.

Mrs. Kent's monograph is a comprehensive and definitive treatise on loom-woven cotton textiles in the prehistoric Southwest. Techniques of weaving and decoration are described and illustrated with utmost thoroughness and clarity. Organization of text and drawings is systematic, so that the reader can readily find detailed information about any single specimen among almost 1000 collected from 114 archaeological sites.

The introduction treats of problems of textile studies, sources of specimens, scope of the inquiry, errors in fiber identification, validation of techniques by laboratory duplication of weaves, and chronological assignment of specimens. By reference to an excellent glossary and numerous skillful illustrations, the text can be easily followed despite the complexity of the subject matter.

The classification of fabrics and weaving processes is entirely adequate yet unobtrusive. The reader is at all times aware of each specimen as a product of aboriginal art and industry, involving a variety of activities from planting and cultivating cotton, through harvesting, carding, spinning, and dyeing fibers, to fabrication of the textiles by men and women. The author's approach is particularly welcome nowadays when the itch to classify sometimes brings on a metaphysical rash that obscures the prehistoric artifacts to be described.

The middle chapters of the monograph are concerned with cultivation of cotton, processing fibers into string or yarn, discussion of dyes and pigments, description of looms and weaving tools, and exhaustive analysis of loom and non-loom weaves. The concluding chapters discuss the various garments and fabrics that were manufactured, and review and summarize regional and chronological relationships of weaves and art styles.

Appendix A contains notes on bast fibers; B is a provenience list, with map, of archaeological sites; C contains 23 charts in which individual specimens are referred to text and illustrations. Appendices B and C, comprising 64 pages of field and museum references to sites and specimens, are certain to be useful to museum curators and preparators.

The value of this study of textiles goes far beyond the technology of particular specimens. Now, for the first time, the study of Southwestern textiles stands on an equal footing with ceramics. One of many possibilities for general interpretations can be visualized by reference to Figures 137, 138, and 139. These textile designs, both woven and painted, exhibit virtual identity with pottery designs of the same age and geographical location, and close similarities also to designs on basketry and those painted on kiva walls. As Kent explains, in the Hopi towns and some of the other pueblo villages, men do the weaving. The occurrence of the loom in prehistoric kivas indicates that men and women, employing 4 different media, perpetuated a single art style through an interval of several centuries.

A few matters of cultural and chronological association will doubtless be questioned by specialists in particular regions of the Southwest. These do not, however, originate with Kent. Her appraisals have been made in accordance with prevailing professional interpretations of Southwestern prehistory. Any conflicts of interpretation are traceable, instead, to several dozens of archaeologists who, during the past 20 years, have placed 1000 pieces of ragged cloth in front of her door, like nameless foundlings left in the dead of night.

One matter of chronology requires comment. Kent is quite correct in expressing caution about the presence of cotton in Tularosa Cave, west-central New Mexico, 500 or more years earlier than its occurrence in any other Southwestern archaeological site. Wendorf (1954, review of "Mogollon Cultural Continuity" by Martin and others, *Amer. Anth.*, Vol. 55, p. 594) has elsewhere questioned the stratigraphic evidence for prepottery occurrence of both cotton and the bow and arrow in Tularosa Cave. Here, it seems sufficient to add only the comment that prepottery cotton is represented in Tularosa Cave by a single piece of 1-ply cordage at a depth where pottery also occurs in prepottery debris, presumably intermixed by rodents or human occupants of the cave at a later time.

Kent is generous in giving credit to her sponsors, associates, and assistants, but these credits in no way diminish her own achievement. This monograph is a standard work; its content will be supplemented by further discoveries but it will never be superseded.

ROBERT F. BURGH
Peabody Museum West of the Pecos
Tucson, Ariz.

Danger Cave. JESSE D. JENNINGS. With a chapter on Textiles by SARA SUE RUDY and 6 Appendices by CHARLES B. HUNT, and ROGER B. MORRISON, CHARLES C. SPERRY, ROBERT L. FONNER, MORRIS F. SKINNER, JESSE D. JENNINGS and CARMA LEE SMITHSON. University of Utah Anthropological Papers, No. 27 and Memoirs of the Society for American Archaeology, No. 14, University of Utah Press and the Society for American Archaeology, Salt Lake City, 1957. xii+328 pp., frontis., 247 figs., 31 tables, 6 appendices. $4.00.

It would not be an exaggeration to say that Jennings' comprehensive monograph has attained a new standard for Great Basin archaeology. Here are deep sites spanning a long period, excavated with precision and interpreted in detail, and with an extensive series of geological, stratigraphic, and radiocarbon time markers.

Three Utah caves are reported — Danger Cave, Raven Cave, and Jukebox Cave, with the first-named being the most productive and most extensively treated. The abundant and diversified specimens, including items of wood, cordage, and basketry, are described in detail. Of particular note is the attention paid to the chipped stone objects, divided into 87 numbered classes. Each class is illustrated (often with both photographs and line drawings), described, and presented with a distribution of comparable specimens. With a typology this complex, probably no 2 archaeologists would classify the collection in exactly the same way, but the information supplied is good enough so that the reader can understand the range and nature of the types defined.

The field photographs are excellent; those taken inside the caves are remarkably clear and detailed. These pictures, plus the complex soil profiles, attest to a painstaking excavation method. The specimen pictures, with a few exceptions, are also of high quality, and the use of almost 250 figures in the monograph makes comparative study much easier.

Theoretically, the finds are fitted into the concept of a long-enduring "Desert Culture" previously identified by Jennings and others. It is now pretty conclusively demonstrated that the prehistoric cultures west of the Rockies followed a quite different path from those to the east, and further, that the Great Basin shows a remarkable stability in many of its basic features.

The chronological relationships of Danger Cave are intricate and not yet entirely resolved, particularly as regards the correlation of radiocarbon and geological dates. Accepting the radiocarbon dates at face value, the earliest occupation of Danger Cave was about 9000 B.C., the latest occupation perhaps at the beginning of the Christian era. This places the initial culture of the site on a time level equatable with Folsom and similar big game hunters, although the culture revealed at Danger Cave is not of this pattern but remains, from early to late, in the "Desert Culture" tradition. Jennings points out a general similarity between the *early* levels of Danger Cave and Tommy Tucker Cave, a site in northeastern California believed to be protohistoric northern Paiute. Since the 2 collections are separated by several hundred miles of distance and presumably at least 10,000 years in time, the observed similarities highlight the difficulties of interpreting a Great Basin site. Workers in other parts of the New World may find it difficult to accept this almost incredible persistence of basic cultural pattern.

Danger Cave shows evidence contrary to 3 commonly held beliefs: that early points are larger than later ones, that obsidian becomes common only in later periods, and that leaf-shaped points are in general older than notched points. The Danger Cave points show a shift from notched to stemless ovoid points, obsidian is the basic material throughout, and the early levels have many relatively small points. This interesting situation deserves further study since it is so different from the apparent sequence in surrounding areas.

It is noteworthy that the Great Basin, a tremendous area long known from fragmentary and often poorly controlled data, has seen the appearance of several extensive studies in the space of only a year or so. In 1956, just before the report reviewed here was published, there appeared Heizer and Krieger's study of Humboldt Cave, Cressman's *Klamath Prehistory*, and Wormington and Lister's study of the Uncompahgre Plateau. Several shorter but highly significant reports also were published, including Riddell's report on the Karlo site in northeastern California. Considering the rapid rate at which new information has appeared, Jennings deserves credit for including some mention of all this in the Danger Cave report. With workers from several institutions now actively contributing to knowledge of Great Basin prehistory, a general understanding of the area should soon be reached. Jennings' present monograph is a substantial contribution toward that end.

CLEMENT W. MEIGHAN
University of California
Los Angeles, Calif.

Pleistocene Man at San Diego. GEORGE F. CARTER. Johns Hopkins Press, Baltimore, 1957. xvi+400 pp., 96 figs., 6 tables, endpaper maps. $8.00.

The principal contention of this book is that man lived in the San Diego area during the Third Interglacial, as early as 100,000 years ago. Such an age corresponds to the Early Paleolithic in Europe. This is a considerably greater antiquity for man in North America than has been suggested previously. Carter's suggestion is a provocative one which merits careful consideration of the evi-

dence presented. Specifically, it is necessary to examine in some detail (1) the validity of artifacts found at San Diego, (2) the evidence that the artifacts are of Third Interglacial age, and (3) the arguments that the Third Interglacial occurred about 100,000 years ago. In doing this, our review will follow the outline used in the book.

The opening statements, which define the central theme of the book, are quoted here in part.

> We have as yet no one system which can solve what we may call the time equation. . . . The need is for an integrative approach in which the various lines of evidence are mutually cross-checking and form a system which can reach well back into the Pleistocene period. A series involving soils, climate, land form, and eustatic sea level offers just such a system. . . .
>
> My findings will show that there is a system of Pleistocene and Pliocene terraces here relatable to the world-wide eustatic terraces. The soils on these terraces will be shown to be products of humid weathering and to show increasing age with increasing terrace height. Finally, it will be shown that artifacts and camp sites are commonly involved in the climatic, sea level, weathering, and geomorphic changes of the Upper Pleistocene.

These are worthy objectives and the use of an approach which combines evidence from several different kinds of sources is commendable.

Pleistocene terminology and absolute chronology are discussed briefly in this chapter. Nineteen radiocarbon dates of samples from Southern California are listed. Carter notes that radiocarbon dates limit the Wisconsin glacial stage in central North America to not more than 30,000 years, which makes it unequivalent to the European Würm and leaves out an earlier glacial period. He proposes that the term *Wisconsin* refers to the period since the sea abandoned its last marine terrace, now 25 feet above sea level. He estimates this interval to be 60,000 to 80,000 years. Evidence on which these figures are based is not discussed in this chapter, but radiocarbon dates are mentioned and the opinion of Seuss (1956, *Science*, Vol. 123, pp. 355-8) is cited.

The discussion of geomorphology is concerned primarily with the effects of eustatic sea-level fluctuations. Zeuner's (1952, *Geologische Rundschau*, Vol. 40, pp. 39-50) correlation of glaciations with marine terraces along the coasts of northwestern Europe and the Mediterranean is accepted without question. Because Zeuner's average values of terrace heights are used, the relations are simplified in a dangerously misleading way. In order to set the record straight, the original data (converted to feet) and Carter's interpretation of them are reproduced below.

Zeuner (1952)		*Carter*	*Correlation*
Range	*Average*		
164-197	197	200	First Interglacial
131-162	131?		
82-115	98	100	Second Interglacial
48-88	59	60	
16-39	25	25	Last Interglacial
8-23	10	10	First interstadial of Last Glaciation
0-7	5		Post-Glacial

The important point is that the spread around an average value of marine terrace heights is very large, and for different reasons in various places. What is even more significant, the agreement on correlation of terraces which Carter repeatedly mentions does not exist (for example, Flint 1957, *Glacial and Pleistocene Geology*, p. 266).

The hypothesis of eustatic marine terraces assumes a stable landmass. During low sea levels of glacial periods streams would cut down and during the high stands of nonglacial time they would aggrade, processes which would produce stream terraces. Ancient wave-cut benches are related to high stands of the sea during nonglacial times. Most of these surfaces in Southern California are covered with alluvial apron deposits, considered by Carter to be dominantly of the same age as the subsequent glacial stage. Radiocarbon dates do not seem to support this contention; rather colluvial deposits continued to accumulate right up to modern times wherever topographic conditions were favorable.

Consideration of evidence for deformation of terrace deposits leads Carter to some curious conclusions. For example, Figure 2 (p. 18) is supposed to illustrate a case of apparent tilting of uplifted old beach deposits caused by different lines of truncation by the sea. Actually, what this diagram shows is that beach deposits have a slight initial dip (dip is a geological term, which refers to the maximum angle of inclination of a plane) and that structural interpretations must be based on true rather than apparent dips, a fact well known to all geologists. In any case the apparent dip is always less than the true dip. What's more, in the specific case cited (the shelf at La Jolla) the true dip is less than a degree, an amount far too small to provide an obvious case of apparent tilting.

Much of the chapter on geomorphology is devoted to the question of tectonic stability. Carter attempts to prove that there has been no faulting or warping in the San Diego area during the Pleistocene. This conclusion does not agree with the evidence put forth by earlier workers. Faulting during the Pleistocene apparently has been relatively minor but the possibility of warping seems very likely (for example, Emery 1958, *Geol. Soc. Amer. Bull.*, Vol. 69, pp. 39-60).

Marine terraces of the San Diego area are described at great length. Results of previous investigations are reviewed and in some cases revised. Carter is rather critical of previous work, but it is difficult to see how he has added to the store of knowledge about these features. His discussion is exceedingly difficult to follow because adequate maps and diagrams are not included. The numerous cross sections are of little aid because they are extremely generalized and in most cases lack vertical and horizontal scales. It is not clear in many cases whether his height measurements refer to the tread of the terrace form or to an abrasion platform or a beach deposit. This is an important point because the marine surface, whether erosional or depositional in origin, commonly is deeply covered by younger nonmarine alluvium.

The terraces recognized by Carter, along with the proposed age assignments are listed below. It should be noted that only terraces at 200 feet and below are considered to be of Pleistocene age and of eustatic origin. These values for heights are apparently averages because the discussion indicates considerable variation

Elevation	*Correlation*
900 500-900 500 400 300	Pliocene
200	First Interglacial
100	Second Interglacial
60 (and 40)	Last Interglacial
25	
10-15	First Interstadial of Last Glaciation
5	Post-Glacial Optimum(?)

between localities. The basis for correlation of the individual terraces is not discussed except in terms of Zeuner (1952, *Geologische Rundschau*, Vol. 40, pp. 39-50) sequence. Thus, Carter states:

> Unfortunately no marine shells have been found on it (the 200 foot terrace). The tendency throughout the world is to place marine terraces at this level in the early Pleistocene and generally to refer them to the first interglacial sea stand (p. 52).
>
> It is clear that the sea stand (at 100 feet) was of long duration and cut wide terraces and large sea cliffs into the headlands. This agrees with a second interglacial assignment since this is generally agreed to have been by far the longest of the interglacial periods and should be reflected in the most extensive terrace cutting (p. 54).

Carter believes that the terraces above 200 feet owe their elevation to uplift whereas those at 200 feet below are of eustatic origin, the result of fluctuating sea levels influenced by glaciation and deglaciation. The fact that there are Pleistocene terraces at considerable heights above sea level is explained by having the ocean basins deepened during the period under consideration. This hypothesis is no more reasonable than several other alternatives, including the possibility that upwarping of the land occurred during Pleistocene time.

In addition to the marine terraces, there are terraces along stream valleys which are believed by Carter to be the result of alluviation during non-glacial periods of high sea level and cutting during glacial periods of low sea level. The heights of these terraces above present stream grade correspond roughly to the heights of wave cut surfaces above present sea level. As will be discussed later, the relationships of stream terraces to marine terraces constitutes a vital part of the evidence for the antiquity of man in the San Diego area.

In a chapter on Climate and Soils only a few pages are devoted to climate. It is argued that rainfall in the San Diego area during a glacio-pluvial period was about 30 inches, or 3 times the present amount. Paleobotanical evidence of uncertain value lends some support to this conclusion.

The principal theme of this chapter is that deep soil profiles require long periods of time to develop, and that many soils are, therefore, old enough to have experienced climatic changes. A main point which Carter tries to establish is that the degree of red coloration of a soil depends primarily on the duration of weathering in a humid environment. He estimates that a truly red soil requires a period of formation equal to at least half the Pleistocene. Red soils in many other parts of the world are mentioned in connection with this aspect of the discussion, though in most cases it is not clear what bearing they have on the problem at hand.

The presentation is especially difficult to follow. Not only does it suffer from lack of adequate maps and understandable diagrams, but also, the description of Southern California soils is almost entirely in terms of the local pedologic terminology, including nearly 2 dozen soil names which are not defined anywhere in the book. In addition, there are many specific points in this chapter to which exception should be taken. A few of these are mentioned below.

Carter apparently discounts the relationship of parent material to the fundamental properties of soils. He does not consider the mineralogical or chemical aspects of weathering at all, but instead, deals only with color, profile properties, and pH. Some of his concepts are patently incorrect. For example, he claims (p. 117) that basic minerals weather more slowly than acidic ones, which is the exact opposite of the correct relation. The possibility that some of the iron and/or clay horizons attributed to weathering in place are actually primary constituents of the deposits is not considered. Also, some of the features referred to as soils by Carter may not be valid weathering profiles (see Kelly 1934, *Amer. Soil Surv. Assoc. Bull.*, Vol. 15, pp. 45-52; Nikiforoff 1937, *Jour. Amer. Soc. Agron.*, Vol. 29, pp. 781-96).

The climatic implications derived from study of calcareous soils seem to be of very questionable value. Carter apparently assumes that the relationship between rainfall and depth of leaching of calcium carbonate in the Great Plains (Jenny and Leonard 1934, *Soil Science*, Vol. 38, pp. 363-82) applies also to Southern California. On this basis, he believes that calcium carbonate "accumulation beginning at 20 to 30 inches in depth suggests rainfalls roughly double modern rainfalls and seems to be of the right order of magnitude of change for a glacial-pluvial period" (p. 173). Considering the technical difficulties in accurate carbonate determinations, and the uncertainties in transposing from the climatic environment and textural type of one region to those of another, the conclusions drawn seem unwarranted.

The discussion of soils, which occupies a large fraction of the book, would have been much more convincing if some detailed work had been done in a few places, so as to give substance to the general conclusions believed to be applicable to a large area. In fact, a few careful mineralogical analyses, especially X-ray studies of clays, plus some chemical determinations of iron and calcium carbonate, would go a long way toward clearing up existing uncertainties.

The chapter on archaeology commences with a brief and incomplete review of previous work. This is followed by descriptions of the locations at which hearths, broken rocks alleged to be artifacts of human manufacture, "food shell," and other items presumed to be evidence of human occupation, are said to be found in deposits called middens. These descriptions comprise an almost random mixture of unconnected sentences dealing with observations on weathering, soil profiles, terrace locations, and buried soils. There is a bare minimum of reference to

human artifacts, and where discussed, it is very difficult to discover from the descriptions where they are located in the section. In some cases, this unsystematic presentation can be organized into comprehensible form. The trouble is that clarification of the description produces results which sometimes do not seem to support the author's contentions.

The site most frequently mentioned in archaeological circles and most extensively described in the book is Texas Street. The major archaeological question is whether or not this site has been occupied by man. If the evidence assembled by Carter is all that can be summoned in the way of proof, the answer is an unequivocal no. It is possible that careful, objective archaeological investigation of the site might change this opinion but present prospects of this are not promising. One of us has seen, at the site, many of the phenomena described and we have carefully inspected at least 3 collections from Texas Street which Carter believes to be artifacts. The stones are quite similar to those illustrated, all "types" being represented in these collections.

The so-called artifacts are pebbles which have been broken by the action of natural forces. Multiple flakes have been removed from cores by percussion and many of the characteristics due to hitting stone having a conchoidal fracture are present. However, it is clear that the source of the blows is not human. The rocks have been flaked and otherwise broken in the gravels during the process of transport and deposition. The fractures on these rocks are not purposeful and there is no consistent pattern to them; rather, the edges, points and other features exhibit wear and battering unlike that produced by human use. Broken rocks of this nature can be found in many other gravels having a suitable lithology and a similar origin and history. In such gravel deposits it is possible by careful selection to find a few forms which have a crude resemblance to human artifacts. However, there is never any question of their origin. The so-called Texas Street artifacts are just such a selection. Rocks that have been chipped on either end and flakes of various shapes suggesting bi-polar flaking, Clactonian technique, and so forth are illustrated in the book. The range of variation, even in the rocks collected, is not illustrated, nor is it the subject of comment. Furthermore, Carter does not describe the "non-artifact" portions of the gravels, nor his criteria for distinguishing between them and the artifacts.

Some 35 chipped rocks from the site are illustrated and it can be inferred from the small amount of internal evidence that about 200, possibly more, presumed artifacts were collected. This is a very low percentage when one considers the tons upon tons of broken rocks which can be seen at the site. However, percentage figures alone are not significant. Carter does not recognize the fact that no matter how crude a human industry may be, artifacts are produced in definable patterns. Characteristic forms are reproduced over and over again and they are easily identifiable at a single site or in sites scattered over a large region. Flakes are removed from cores in specifically definable ways which repeat themselves. This regularity or consistency is not seen in the Texas Street chipped rocks unless a very careful selection is made. Even so, to make such a highly graded collection requires manipulation of criteria and ignoring of features to be observed on the rocks. Carter suggests that, "The presence of bipolar flaking at Choukoutien suggests that the Texas Street industry may also belong to the Soan tradition of the stonework" (p. 369). Apparently, he is unable to recognize the striking difference between naturally broken rocks and the various types of tools produced by a well established human industry. His opinions on this comparison are utter nonsense.

If the broken rocks are not human artifacts, what of the hearths? Here we are frustrated by the lack of suitable description. The single illustration of a hearth is a photograph from Texas Street. The charcoal layer runs out of the picture, there is no scale and no measurements are given, and explanation of the irregularity in the deposit is not found. Nothing is said of its horizontal plan and whether or not "artifacts" were found here. As a description of important evidence, this is pathetically unsuccessful. There is no definite evidence that this is of human origin. It is unreasonable to assume that all fires are caused by humans. To prove that a bed of charcoal is the remains of a fire built by humans it must have properties which are not natural. Human hearths, even the most simple ones, can sometimes be identified by specific details of their form and content. Obviously identification must be done with great care, and even so, success is not guaranteed. Many burned areas in well established campsites can be proved to be of human origin; that others are hearths is often an *a priori* assumption. The evidence presented for Texas Street is quite inadequate. One likely explanation, and this applies also to the Campus site at La Jolla, is that matted vegetation, including possibly wind-blown silts, accumulated in shallow depressions, or was caught in low lying vegetation on a flat surface and later was set alight by a brush fire. In a moderately dry environment such a fire, especially if partly smothered by silt, will smoulder for days producing the charcoal, the pink clays at the base, and, as one of us has observed at the site, a discoloration of the overlying materials. Fires of this sort would produce burned rocks which are the subject of extensive comment in the book. Such burned rocks are very difficult to distinguish from the much greater number of weathered rhyolite-porphyry cobbles and pebbles widely distributed through the deposit. It is well known that the chemical weathering of rhyolite produces a red rind, and some pebbles are more deeply weathered than others. Such differences in weathering are not restricted to the deposits at Texas Street. The bits of burned bone can easily be of natural origin, and it certainly is not necessary to invoke man to account for the very few shells found. It is very likely that these were carried by gulls and ravens, and by animals, aided and abetted by streams. In sum, the simple, well known, and rather fully developed and reasonably precise archaeological methods for identifying human occupation and industry seem to have been cynically ignored. There is no conclusive evidence at present that the Texas Street site was ever inhabited by man.

Details of the geologic situation at Texas Street are exceedingly difficult to decipher from Carter's description. It is stated that the site occurs in a remnant of an alluvial terrace along the San Diego River, but convincing evidence for this mode of origin of the deposits and the associated topographic form is not presented. The sequence is considered to involve (1) a period of valley filling, when gravels were deposited; (2) excavation of valley fill; (3) valley filling, when sands and clays were deposited by the river, with interbedded gravels (incorrectly called fanglomerates) near the valley walls: this is the layer which contains the alleged artifacts and charcoal dated at greater than 35,000 years; (4) excavation of valley fill and dissection by minor tributaries; and (5) valley filling to present level. The way in which an age for the "artifacts" is arrived at is quoted (p. 312):

> This is a record of alternating periods when the sea was low in relation to the land, with valley excavation and acompanying humid conditions, followed by periods when the sea was high in relation to the land, with consequent valley filling under arid conditions. This is read as a glacial-interglacial-eustatic-climatic change record. Since the valley floor is now at an elevation of 40 feet, the minimum sea-level rise to create an alluvial fill here to the 100-foot level would seem to be 60 feet. This fill is therefore attributed to the early third interglacial sea stand of that height.

It seems a pity that the author does not give enough information to allow the objective reader either to agree or disagree with his conclusion on this vital question of age, which constitutes the central theme of the book.

In addition to Texas Street, Carter has identified and described several other sites in the San Diego region. Some of these were apparently once human camp sites. The descriptions are aimed at placing these sites in a geological section so that their age may be determined. There is a minimum of consideration of the archaeological problems, which are as significant in chronological determination, as are estimates of the rate of soil formation and related processes. Among the sites described there are localities in which broken rock appears in deposits which are described as middens but the poorly presented data render identity of these dubious in the extreme. As a background for some of his discussions of cultural problems Carter has selected some opinions which Rogers published in 1939 and which he considered obsolete in 1949. Furthermore, Carter has chosen to pass over opinions reached by Haury and accepted by Rogers (Haury 1950, *Ventana Cave*) in the consideration of the sequence at Ventana Cave. Aside from a paper by Treganza (1942, AMERICAN ANTIQUITY, Vol. 8, pp. 152-63), Carter has ignored important and definitive papers by students with vast experience and knowledge such as Heizer, Brainerd, and a number of others (for example, Heizer 1952, *Reports of the Univ. of Calif. Archaeol. Surv.*, No. 16; a long list of references could be quoted). The account in this book is a very one-sided and incomplete one which contributes nothing to our knowledge of the archaeology of the area.

The main conclusions of the book are brought together in a correlation chart (Table 6, pp. 370-1) which is meant to establish the age relations of the alleged archaeology. For reasons not fully explained, granite weathering ratios of glacial deposits in the southern Rocky Mountains, reported by Nelson (1954, *Jour. Geol.*, Vol. 62, pp. 325-43), are included. It is stated that the sea level values given were taken from Shepard and Suess (1956, *Science*, Vol. 123, pp. 355-8), but the information they give is not the same as that listed in Carter's chart. Chronological data were adapted from Emiliani (1955, *Jour. Geol.*, Vol. 63, pp. 538-78) and Suess (1956). Carter accepts Emiliani's suggestion that what is commonly referred to as the last glacial stage in North America (the Wisconsin) includes only the latter half of that stage. This conclusion is based on ocean temperature curves derived from oxygen isotope analysis and extrapolation of radiocarbon chronologies. According to Emiliani, the last interglacial occurred more than 80,000 years ago. Carter, accepts this conclusion, but fails completely to discuss the many dubious assumptions that are involved in it. Also, he implies that the pollen and radiocarbon data of Clisby and Sears (1956, *Science*, Vol. 124, pp. 537-9) for the San Augustin Plains, New Mexico indicate that the last interglacial occurred prior to 80,000 years ago. This is an obvious misinterpretation of their conclusions. At any rate, "artifacts" at the Texas Street site are considered to be approximately 100,000 years old, based on Carter's belief that the deposits in which the "artifacts" occur are correctly correlated with the Third Interglacial. As was mentioned previously, radiocarbon dating indicates that the charcoal in these deposits is more than 35,000 years old.

In summary, the reviewers feel that Carter has failed to present convincing evidence for the presence of artifacts of Third Interglacial age at San Diego. Furthermore, the conclusion that this interglacial occurred approximately 100,000 years ago seems to be without adequate foundation. Even if we could agree that Carter's artifacts are valid and his dating of them correct, we would still feel that the flaws in presentation of this book greatly outweigh any conceivable potential merits. The major points of contention have been discussed above, but there are many other errors, misinterpretations, or otherwise questionable matters on which comment cannot be made here for lack of space.

The subject discussed in this book is perennially fascinating and highly controversial. We wish that in presenting these somewhat radical opinions, Carter had been more careful to separate fact from fancy, so as to give the reader a chance to make up his own mind about the crucial aspects of the argument. The way in which scrambled shreds of valid evidence and a potpourri of unbridled speculations are intermixed to support his views will surely try the patience of even the most lax devotee of scientific method. The contribution of this book to the question of man's antiquity at San Diego, and elsewhere in the New World, is a very meager one.

FREDERICK JOHNSON
R. S. Peabody Foundation for Archaeology
Andover, Mass.

JOHN P. MILLER
Harvard University
Cambridge, Mass.

The Adena People — No. 2. WILLIAM S. WEBB and RAYMOND S. BABY. With chapters by CHARLES E. SNOW and ROBERT M. GOSLIN. Ohio Historical Society, Ohio State University Press, Columbus, 1957. xi+123 pp., 49 figs., 10 tables, 1 chart, endpaper map. $3.00.

This attractive volume, the third of a series of analyses of the Adena culture, initiated by Emerson F. Greenman in 1932, is intended to be a supplement to the larger study of both cultural and skeletal remains entitled, *The Adena People*, by William S. Webb and Charles E. Snow (University of Kentucky, 1945). Data from 49 new sites, most of them unpublished, have been integrated with the 1945 series. In addition there has been some modification of 40 of the 218 previously listed traits, and 25 new traits have been added as the result of subsequent site excavations and the reinterpretation of old data. Certain of the latter are of special interest in suggesting connections with Early Woodland sites outside the recognized Adena area. The inclusion of a new pottery type, Adena Punctate, seems somewhat precariously based on a single occurrence in the Cordray Mound.

Because of the general dearth of knowledge of Adena habitation sites and of the perishable content of the culture, the authors' conclusions from a recent restudy of rock shelter data from eastern Kentucky are of considerable interest. They would assign Adena provenance to the lower level of a number of the unstratified dry shelters which produced, among other evidence, the moccasins, textiles, and cradleboard (a device long suspected as a major instrument in the cranial deformation seen on Adena skulls) "in direct association with known Adena artifacts" (p. 34). Although this reviewer is not disposed seriously to question this identification by association, there remains an uneasy sense of the possible intrusion of some of the material from higher levels created by later inhabitants.

Goslin's chapter summarizes current knowledge of Adena animal and vegetable foods, as revealed through excavations, some unpublished, at 23 mound sites in Ohio, Kentucky, Indiana, and West Virginia, and on 10 Kentucky rock shelters which produced Adena cultural remains. Only 2 mounds (Florence and Cowan Creek, both in Ohio) and 1 shelter (Newt Kash Hollow) yielded residues of cultivated plants, identified as squash or pumpkin, gourd, and sunflower. Both mound sites are of Late Adena age (1425±250 and 1509±250 B.P., respectively), being of the series, the "youngest sites dated by the radiocarbon method" (p. 42). Squash and sunflower remains (the later found in human coprolites) from the shelter are apparently older (2600±300 B.P.). No corn is reported from any Adena site, although its use is suspected by Goslin (p. 45). Might the search for corn pollen in suitable Adena habitation sites prove rewarding?

Snow, in a chapter headed "Adena Portraiture," reaffirms his previously expressed views (1945) concerning the physical typology and provenance of the Adena People, or at least of that highly selected segment pertaining to "individuals apparently distinguished from all others by virtue of their rank, honor and birth" (p. 53). His comparative studies reveal that the "Adena People and the Hopewell People, their close contemporaries, are clearly of different population origins. On the other hand, the Tennessee Stone Grave crania are similar to those of Adena in dimensions and proportions," and like the latter, "are deformed, the heads having been shaped artificially in infancy" (p. 51). For the presence in the area of this type, called "Walcolid" by Neumann, Snow continues to look "down Mexico way" (p. 59), finding possible prototypes in Archaic crania from the Valley of Mexico, and even in Tepexpan Man.

This reviewer feels that Snow has too facilely dismissed consideration of a potential reservoir lying north of the Ohio Valley, as indicated by the Late Archaic and Early Woodland Walcolids of New York State. His chief objection seems to be that the latter are undeformed, a purely cultural trait that might very conceivably have been added locally by influences from the south. The possibility that significant cultural elements of Adena may also have been contributed from sources north of the Ohio Valley on an Early Woodland horizon, radiocarbon dated in New York well over a millenium earlier than the oldest yet obtained Adena date, is however alluded to by Webb and Baby (p. 103).

In chapters 6, 7 and 9, evidences for supernaturalism in the Adena culture are adroitly analyzed and interpreted, making this, perhaps, the most absorbing portion of the monograph. Shamanistic impersonation of the wolf, puma, and bear seems well attested, the use of medicine bundles less so.

With respect to the puzzling stone or clay Adena "tablets," the authors' skillful analysis of design motifs leads to the assumption "that the Adena People recognized an important Being, typified by a large raptorial bird which was sometimes impersonated by men" (p. 99). They further ingeniously suggest that this bird may have been the carrion crow (or another species of vulture, the addition of scientific names for these birds would have contributed to clarity), "agents of the spirit world" (p. 101), because of the habit of such birds of feeding on the flesh of corpses, exposed as part of a mortuary custom which involved the cremation of denuded bones, rather than bodies in the flesh, a fact determined by careful studies of the burned remains.

In their laudable efforts to penetrate further into the obscurities of Adena magical concepts and practices, Webb and Baby advance an additional hypothesis concerning the use of the tablets themselves, namely, that they "were made and engraved for the express purpose of stamping on the clothing or the body of a number of individuals on appropriate occasions the symbols and motifs of the cult to which those receiving the stamp were adherents" (p. 96).

In Chapter 10 an attempt is made to show that a substantial number of the 51 art motifs and other traits attributed by Waring and Holder to the Southern Cult occur also in Adena and/or Hopewell, and may have been derived from one or the other of these cultures. For some of the more distinctive motifs, the bi-lobed arrow,

hand-eye design, and horned serpent, for example, the parallels are indeed arresting. This chapter would have been improved by a fuller discussion of the subject. Here, as elsewhere in the work, too much reliance has been placed on tabulation of data, not enough on explanation.

The chronology of Adena occupies the final portion of the work. A tripartite division, with chronological markers in burial custom; houses; and tools, implements, ornaments, is given for the culture which, as currently revealed by radiocarbon analysis, spanned a long period from about 1200 B.C. to about A.D. 900. It is thus seen partially to antedate Hopewell, which also survived it, as illustrated in the chart at the end of the volume.

There are tantalizing suggestions of the authors' thoughts on the relationship of earlier cultures to Adena, and of Adena to Hopewell, and it is regrettable that these important matters could not have been further explored in this major contribution to the archaeological literature of the Ohio Valley.

WILLIAM A. RITCHIE
New York State Museum
and Science Service
Albany, N.Y.

The Glen Canyon Survey in 1957. ROBERT H. LISTER. University of Utah, Department of Anthropology, Anthropological Papers, No. 30 (Glen Canyon Series No. 1), University of Utah Press, Salt Lake City, 1958. vi + 52 pp., 24 figs., 2 tables. $1.25.

This timely volume inaugurates a new "series within a series" by the University of Utah, reporting salvage archaeology in the Glen Canyon area of southern Utah. The dispatch with which this report has been made available augurs well for the Glen Canyon reports to follow. Barely 6 months elapsed between conclusion of field work and publication date. While the archaeological reporting is unusually brief, one must admit satisfaction in having a published statement on truly current work.

The archaeological survey conducted by Lister represents one phase of the larger Glen Canyon salvage archaeology project awarded to the University of Utah by the National Park Service. Jesse D. Jennings is the Project Director. The area surveyed extends from the Glen Canyon dam site in northern Coconino County, Arizona, up the Colorado River to the Escalante River and includes the tributaries of the Colorado River entering from the north between Wahweap Creek and the Escalante River, inclusive. Along the intervening drainages the survey extended up to the 3700 foot contour, the full pool level of the Glen Canyon reservoir. The greatest distance from the dam extends 75 miles up the Colorado River to the mouth of the Escalante River and 33 miles up the Escalante River to the 3700 foot contour.

Difficult of access and even more difficult to traverse, this area has not had previous archaeological work. Sites recorded during the survey numbered 105, about ⅔ of which were along the Escalante River and its tributaries. Lister points out that this distribution of sites favors the areas in which springs of potable water are relatively abundant.

Between Last Chance Creek on the west and the Escalante River on the east lies the high, forested Kaiparowits Plateau. Because it lies well above the full pool level of the Glen Canyon reservoir, this plateau was not included in the survey area. However, a brief reconnaissance of a portion of the Kaiparowits Plateau led Lister to state (p. 2): "From a scientific point of view it appears that the problems of prehistory of much of the area we have surveyed are linked with the Kaiparowits Plateau, apparently the cultural center of the area."

It is unfortunate that no description or illustration of artifacts is given and that nowhere is there any indication as to the cultural affiliations or age of the sites recorded. The latter, at least as far as my interests are served, is perhaps the greater fault. Surely the survey material must have given some clue on which to base a tentative statement. The minimal information to be derived from a surface survey would ordinarily include at least this much.

Notwithstanding these last comments, the present report and those to follow in the Glen Canyon Series of the University of Utah should comprise a useful body of literature on an area heretofore archaeologically unknown.

WILLIAM W. WASLEY
Arizona State Museum
Tucson, Ariz.

Traces of Early Man in the Northeast. WILLIAM A. RITCHIE. New York State Museum and Science Service, Bulletin No. 358, University of the State of New York, Albany, 1957. 91 pp., 2 figs., 18 pls., 1 table. $1.50.

Ritchie has amassed a good deal of useful information in this report. More than half the booklet consists of generally fine photographs with captions giving locations of artifacts from New York and the Reagan site in Vermont. Both faces of the many fluted points are illustrated. Location, source, and description of these and other fluted points from New York is provided in the table. The distribution of fluted points in the Northeast is plotted on 2 maps, relating find-spots to different phases of post-Pleistocene lakes. While finds of fluted points from New England are not tabulated or illustrated, references to major sites are listed in the comprehensive bibliography.

In the brief text, Ritchie presents a closely worded argument to the effect that fluted points in the Northeast are restricted to a time period from 3500 to 5000 B.C. Lacking samples that might be dated directly by radiocarbon, Ritchie bases these dates on 2 assumptions: (1) that fluted point complexes are earlier than Archaic cultures in the Northeast which are at least 5500 years old; and (2) that post-Pleistocene waters, covering land where fluted points are now found, would have prevented human occupation presumably before 7000 years ago.

Few archaeologists will question the premise that fluted point complexes are older than the Archaic. But

the maximum age of about 5000 B.C. for the beginning of paleo-Indian occupancy of the Northeast is controversial. This date is based partly on geological argument.

The Champlain Sea inundated parts of upper New York about 7000 years ago; and immediately before that time, the closing stage of Lake Iroquois and the Fort Ann stage of Lake Vermont covered land on which 41% of the fluted points from New York were located. Since man could only have occupied this land after the subsidence of the waters, Ritchie infers the recency of paleo-Indian hunters in the Northeast.

Even if the terminal date of Lake Champlain should prove to be about 5000 B.C. (radiocarbon dates place it about 11,000 years ago), one cannot properly conclude that *all* fluted points in the Northeast belong in a "relatively brief and recent interval falling somewhere approximately betwen 3500 and 5000 B.C." (p. 17). Ritchie recognizes this overgeneralization. He notes that the Shoop site seems to be on the Clovis level. If so, a more appropriate conclusion might be the striking persistence of the fluted point tradition in the Northeast, contrasting with what is known in the Great Plains.

Ritchie has drawn further inferences from his distributional study. He points out that fluted point makers probably wandered freely in tiny bands through unoccupied country. He demonstrates their preference for well elevated situations along the main waterways; and suggests that they migrated along the river valleys from the south or southwest. He has strengthened his position with lithic analysis and climatic relations. These sound inferences suggest that paleo-Indian studies would profit immensely from similar distributional studies throughout North America.

RICHARD G. FORBIS
Glenbow Foundation
Calgary, Alberta

Ferry Site, Hardin County, Illinois. MELVIN L. FOWLER. Scientific Papers, Vol. 8, No. 1, Illinois State Museum, Springfield, 1957. 36 pp., 14 figs., 3 pls.

Rutherford Mound, Hardin County, Illinois. MELVIN L. FOWLER. Scientific Papers, Vol. 7, No. 1, Illinois State Museum, Springfield, 1957. 44 pp., 5 figs., 17 pls., 3 tables.

These reports deal with 3 sites near the confluence of the Saline River with the Ohio River in southern Illinois. They are located within a ½ mile radius in varied topographic situations. One site (Rutherford) was found on a hill some 160 feet above the flood plain of the Ohio, while another site (Kaegi, mentioned in the same report), is located on the flood plain proper. The third site is situated at an elevation between the other 2, on what is apparently a remnant of a terrace 60 feet above the present bottom land.

This latter site (Ferry) is the earliest and consists of a shallow occupation midden within a minimum area of about 250 by 300 feet. Eight test pits revealed that most of the cultural deposit was concentrated in the plow zone, or immediately below to a maximum depth of 2 feet. Among the interesting features of this site were 3 large, irregular areas of burned earth; their function is unknown. Another curious fact is that no faunal remains were discovered in the excavations, although local farmers mentioned that bones had been plowed up at the site. The author suggests that the bones were concentrated in a less acid soil layer which has eroded away.

Because the site was shallow and showed, "no stratigraphy," all of the artifacts were analyzed together and presented as a total assemblage for the site. This practice leaves the reviewer somewhat uneasy, for it militates against the possibility of discovering any stratigraphy that might exist. Using the minimal dimensions for the areal extent of the site given above, together with the size of the excavations indicated in Fowler's Figure 2, one arrives at an estimate of less than 2% of the total site area being excavated. While this is a rather small excavation sample, the assemblage of artifacts appears to bear out the view that it is a single component site. The assemblage includes a relatively full complement of "Archaic" stone tools, with bannerstones and projectile points as the 2 groups most important for our purposes.

Twenty-two bannerstones are recorded from the site, most of them broken along the main axis of the central perforation. Since they were all probably bilaterally symmetrical, it was possible to offer reconstructions of these pieces. Both the fragments and the reconstructed forms are well illustrated by excellent drawings and photographs. Fowler discusses the rather wide range of forms among these bannerstones by using an adaptation of the terminology published by Knoblock (1939, *Bannerstones of the North American Indian*). Most of the reconstructed forms are reasonable, though in some cases there are quite small, relatively undiagnostic fragments to go on. To the reviewer's mind, the most tenuous reconstruction appears to be that of the "knobbed lunate" form. The author points out that there are only 3 other sites known to have yielded as many or more bannerstones than the Ferry site, all larger sites of the Kentucky Archaic.

The artifacts most diagnostic in assessing the temporal relationships of the site were the projectile points and, from the much larger proportion of corner-notched and expanding-stemmed forms over side-notched points the site is placed in the late Archaic "period." On the basis of resemblance to assemblages in the radiocarbon dated Modoc Rock Shelter in Illinois and the Carlson Annis Mound in Kentucky, Fowler suggests a date of 2500 B.C. for the Ferry site. Functionally, the site is interpreted as a campsite resembling some Kentucky shellmounds in artifact content, but differing in the apparent economic base. The absence of faunal remains together with the relatively large numbers of milling and nutting stones indicate a propensity for vegetal foods.

The Rutherford mound, perched on a ridge overlooking the Ohio Valley, was rather small (10 feet high and 60 by 75 feet at the base) and unlike the Ferry site was almost completely excavated. It resembles others in Illinois with its white, sandy clay floor placed directly on

the sub-soil, basket-loaded primary mound fill, together with a secondary mantle. Significant variation was noted, however, in the fact that the mound contained no central tomb and that many of the burials were either dismembered or partially disarticulated before burial. Of the interments, 14 were made either beneath or in the clay floor. Over this the primary mound was built to a depth of 2 to 3 feet, and 20 more interments were made. A few bones found in the primary mound fill were assigned a number, making a total of 35 burials noted in the excavation. A secondary fill and humus layer brought the mound to its maximum height before excavation. There may have been more burials originally for relic hunters had disturbed the site. (We are promised detailed descriptions of the skeletal material in a later report.)

The artifact complement of the mound, largely burial associations, overlaps a good deal with other Illinois Hopewell assemblages, but there are several categories that deserve mention here. The pottery includes Weaver Ware, rocker-stamped and cross-hatched rim sherds, and a simple-stamped, tetrapodal vessel that points toward the late Archaic of the Southeast. Perhaps the most unusual find was a cache of rings, associated with a burial, made of pottery, sandstone, cannel coal and jet. These objects range from 69 mm. to 195 mm. in outside diameter and somewhat resemble ear spools found in other Hopewellian sites, although most of them are rather large to have been used for that purpose. Two of the most handsome finds were curve-based bird effigy pipes, one of conglomerate (a raven) and the other of Ohio pipestone (a falcon). These together with other stone and clay platform pipes, panpipes, copper bi-cymbal ear spools and rocker-stamped pottery leave no doubt of a Hopewellian affiliation for the site. The presence of Weaver Ware indicates late Illinois Hopewell, while a radiocarbon determination (from a sample taken, "just above the floor") gives a date of A.D. 432 ± 200.

Down on the bottom land near the Rutherford Mound and the Ferry site, a surface collection was made from an area several acres in extent. This is the Kaegi site, and a brief description of the material and 2 plates are inserted at the end of the Rutherford report. The presence of prismoidal flake knives and rocker-stamped, clay-tempered potsherds indicate an affiliation with the Rutherford Mound — perhaps this was the village site.

Fowler is certainly to be commended for his prompt reporting of these sites. The descriptions and illustrations are for the most part quite clear, and the comparative discussions are pertinent. A few queries remain, however: a) about the nature of the burned areas at the Ferry site (perhaps more digging would provide an answer); b) about the excavation techniques — not as a reflection on the excavator, but the reviewer submits that enough information ought to be given so that the reader can weigh the evidence for himself; c) about the publication of the 2 papers under separate covers — our bibliographic problems should be cut down where possible, not multiplied. These queries are not meant to detract from the solid contribution of these papers for we need more such site reports to provide the necessary foundation upon which culture-historical correlations can be made.

Robert E. Greengo
University of Washington
Seattle, Wash.

ANNUAL MEETING OF THE SOCIETY FOR AMERICAN ARCHAEOLOGY, 1958

The 23rd Annual Meeting of the Society for American Archaeology was held on Thursday, Friday, and Saturday, May 1, 2, and 3, at the Extension Study Center on the North Campus of the University of Oklahoma, Norman, in conjunction with the Annual Meeting of the Central States Anthropological Society.

Meeting of the Executive Committee

As required by Article VI, Section 3, of the Society's Constitution, the annual meeting of the Executive Committee was held prior to the annual business meeting of the Society. An account of this meeting is included in the report of the Secretary.

Annual Business Meeting

The annual business meeting was called to order by President George Quimby at 4:33 p.m. on Friday, May 2, 1958, with about 80 members present.

The minutes of the 22nd Annual Meeting were approved as published in American Antiquity, Vol. 23, No. 2, pp. 209-14 (October, 1957).

The report of the Treasurer (printed below) was read and accepted by the membership on the recommendation of the Auditing Committee (Don W. Dragoo, P. Schuyler Miller).

The report of the Secretary (printed below) was read and accepted by the membership.

The report of the Editor (printed below) was read and accepted by the membership.

The Elections Committee (David A. Baerreis, Joan E. Freeman, William S. Laughlin) reported the results of the mail ballot (394 ballots received) as:

President: Richard B. Woodbury
First Vice-President: Albert C. Spaulding
Second Vice-President: Pablo Martínez del Río
Editor: Raymond H. Thompson
Members of the Executive Committee (to 1960): Douglas S. Byers, Waldo R. Wedel.

New Business

A brief report on the activities of the Highway Archaeological Salvage Committee was presented by its chairman, Fred Wendorf and another on the work of the Committee for the Recovery of Archaeological Remains by the representative of the Society, Reynold J. Ruppé, Jr.

The following resolutions were presented by the Committee on Resolutions (Douglas S. Byers, Clarence H. Webb) and accepted by the membership:

Be it resolved: That the Society for American Archaeology, assembled at its 23rd Annual Meeting, expresses its sincere thanks to George L. Cross, President of the University of Oklahoma, to Stephen C. Borhegyi, Director of the Stovall Museum of Science and History, to Lee Hayden, Director of Short Courses, and to their staffs, for the hospitable reception afforded the Society and the privilege of using the facilities under their care.

Be it resolved: That the Society for American Archaeology expresses its thanks to the Program Committee and the Committee on Local Arrangements for the fine program and extracurricular attractions prepared for this meeting.

Be it resolved: That the Society for American Archaeology expresses to Frederick Johnson its appreciation of his hard work and deep devotion to the interests of archaeology as evidenced in the part which he played in the organization of the Committee for the Recovery of Archaeological remains and in his 10 years of service as Secretary of that Committee and representative of the Society.

Be it resolved: That the Society for American Archaeology expresses to Richard B. Woodbury its sincere thanks for his unflagging devotion to the task of maintaining American Antiquity and its standards so that its stature among anthropological journals has steadily increased during his tenure as Editor.

Be it resolved: That the Society for American Archaeology expresses its deep sense of loss in the deaths of the Reverend Victor Rose Stoner and Richard Fowler Van Valkenburg and directs the Secretary to write to their survivors expressing these sentiments.

The annual business meeting adjourned at 5:23 p.m.

Annual Dinner

An informal dinner was held on May 2 at 6:30 p.m. at the Oklahoma Memorial Union, Norman, in conjunction with the Central States Anthropological Society.

Other Sessions

Thursday, May 1, afternoon. James B. Griffin, Chairman.

1. John M. Goggin: Oven Hill, and 18th Century Seminole Site on the Suwanee River, Florida.
2. Emily J. Blasingham: Description, Distribution and Typological Relationship of Yankeetown Pottery.
3. Raymond W. Wood: A Gibson Aspect Component in Southwestern Missouri.
4. Blanche Miller: Kansas Corner Tangs.
5. William N. Irving: Preceramic Remains in Central South Dakota.
6. Wilbur A. Davis: Archaeology of Lake Winnemucca Caves, Nevada: A Preliminary Statement.

Thursday, May 1, evening, *Session* A. Stephen F. Borhegyi, Chairman.

1. Walter Taylor: Recent Results in Mexico's Developing Interest in North Mexican Archaeology.
2. J. Charles Kelley: A Proposed Revision of the Archaeological Sequence in Sinaloa, Mexico.
3. Robert L. and Barbara C. Rands: The Incensario Complex of Palenque, Chiapas.
4. Raymond H. Thompson: A Burial Cache from Uayma, Northeastern Yucatán.

Thursday, May 1, evening, *Session B.* Charlie R. Steen, Chairman.

1. Robert C. Euler: Prehistoric Movements of the Pai, an Upland Arizona Yuman Tribe.

2. Elizabeth Ann Morris: Basketmaker Caves of the Prayer Rock District, Northeastern Arizona.

3. Rex E. Gerald: A Pueblo Kiva on the San Pedro River of Southeastern Arizona.

4. William W. Wasley: A Ceremonial Cache from Bonita Creek, Southeastern Arizona.

Friday, May 2, morning (in conjunction with the Central States Anthropological Society). E. Mott Davis, Chairman — Symposium: Relationships Between the Caddoan Area and Neighboring Areas.

1. E. Mott Davis: Report on the Caddoan Conference and Statement Delimiting the Caddoan Area.

2. Clarence H. Webb: Relationships Between the Caddoan Area and Louisiana. Discussants: James A. Ford and Alex D. Krieger.

3. James B. Griffin: Relationships Between the Caddoan Area and the Mississippi Valley. Discussants: Philip Phillips, Stephen Williams, and Alex D. Krieger.

4. Robert E. Bell: Relationships Between the Caddoan Area and the Plains. Discussants: David A. Baerreis, Marvin F. Kivett, and Robert L. Stephenson.

5. Edward B. Jelks: Relationships Between the Caddoan Area and Texas. Discussants: T. N. Campbell and J. Charles Kelley.

Friday, May 2, afternoon. James B. Shaeffer, Chairman.

1. G. H. Bittle: Salvage Archaeology and the Oklahoma State Highway Department.

2. Elaine Bluhm: Organizing Archaeological Data for Salvage Work.

3. Charlie R. Steen: Salvage Programs in the United States.

4. Jesse D. Jennings: The Glen Canyon Dam Salvage Project.

5. Richard G. Forbis: The Salvage Problem in Canada.

6. Ignacio Bernal: Problems of Salvage Archaeology in Mexico.

Saturday, May 3, morning. Jesse D. Jennings, Chairman.

1. Carol K. Rachlin: The Historic Position of Fabrics in Eastern United States.

2. Charles R. McGimsey, III: A Survey of State-Supported Archaeological Programs.

3. William A. Ritchie and Don W. Dragoo: The Eastern Dispersal of Adena.

Report of the Secretary

Committees. The following regular committees were appointed by President George I. Quimby and approved or elected by the Executive Committee as required by the Constitution and By-Laws of the Society.

Nominating Committee: Irving Rouse, Chairman; James B. Griffin, and W. C. McKern.

Viking Fund Award Committee: Kenneth E. Kidd, Chairman; Junius B. Bird, William G. Haag, Emil W. Haury, Alex D. Krieger, Clement W. Meighan, Douglas Osborne, Frank H. H. Roberts, Jr., and Arnold M. Withers.

Program Committee: Robert E. Bell, Co-Chairman (SAA); William E. Bittle, Co-Chairman (CSAS); Norman A. Chance, Stephen F. Borhegyi, and James B. Shaeffer.

Local Arrangements Committee: Stephen F. Borhegyi, Chairman; Robert E. Bell, William E. Bittle, and James B. Shaeffer.

Auditing Committee: Don W. Dragoo, Chairman, and P. Schuyler Miller.

Elections Committee: David A. Baerreis, Chairman; Joan E. Freeman, and William S. Laughlin.

Resolutions Committee: Douglas S. Byers, Chairman, and Clarence H. Webb.

John Corbett and William A. Ritchie were appointed members of the Committee for Highway Salvage Archaeology to replace Clifford Evans and Irving Rouse. The Executive Committee approved the expenditure of $1500 donated by the Associated Contractors of New Mexico to finance a meeting of the Committee for Highway Salvage Archaeology and the printing of a booklet covering this work and also approved carrying over the unexpended balance of the funds to the following year.

Reynold J. Ruppé, Jr. was appointed as representative of the Society for American Archaeology on the Committee for the Recovery of Archaeological Remains.

Douglas S. Byers (8 year term) and Frederick S. Johnson (4 year term) were appointed Trustees of the Permanent Fund to bring the Society's operations in conformity with constitutional requirements.

James B. Griffin was chose by the Viking Fund Award Committee as the 1957 medalist.

The Nominating Committee presented the following names for the 1958 election of officers: for President, Richard B. Woodbury; for First Vice-President, Albert C. Spaulding; for Second Vice-President, Pablo Martínez del Río; for Editor, Raymond H. Thompson; for First Executive Committee member (to 1960), Douglas S. Byers, John L. Champe, Douglas W. Schwartz; for Second Executive Committee Member (to 1960) George I. Quimby, Adan Treganza, Waldo R. Wedel.

The following members of the Society were appointed official delegates to the meetings listed: James B. Griffin to the 5th International Congress of Quaternary Studies, Spain; Clifford Evans and Richard B. Woodbury to the 33rd International Congress of Americanists, Costa Rica; James B. Griffin to the 5th International Congress for Prehistoric and Protohistoric Sciences, Hamburg, Germany.

The Executive Committee held a special meeting at Chicago, Illinois, in December, 1957 and its regular meeting in Norman, Oklahoma, on April 30, 1958. Its actions during the fiscal year (other than approval of the appointments noted above) include acceptance of the invitation of the University of Utah to hold the 1959 annual meeting at Salt Lake City on the dates April 30 to May 2, 1959. The invitation of Yale University to hold the 1960 meeting at New Haven was also accepted. It was recommended that future Executive Committees attempt to arrange the meeting place 2 years in advance. The Executive Committee approved the Editor's, Treasurer's and Secretary's reports for 1957-58 and the proposed budget for 1958-59 prepared by the Treasurer. The special actions listed below are also authorized by the Executive Committee.

Upon the invitation of the Board of the American Anthropological Association, the Society for American Archaeology joined with the AAA and the American Association of Physical Anthropologists in preparing a scroll which was presented to Paul Fejos at the list Viking Fund Award dinner in testimony of the Society's appreciation of his service to the profession.

The President and Secretary were instructed to protest to the Arkansas Publicity and Parks Commission, Sam B. Kirby, Director, regarding an invitation, published in newspapers, for tourists to come to Arkansas "to dig Indian mounds and ancient storage vaults, tusks, teeth, and bones of elephants — buried Indian relics and pottery."

The Secretary was instructed to drop from the complimentary and exchange list the following institutions: Boletín Indigenista, Instituto Indigenista Interamericano, Mexico; Science Service, Inc., Washington; Scientific Library Division, Bureau of Science, Manila; Universidad Central del Ecuador, Biblioteca, Quito; and Luís Valcárcel, Museo Nacional del Perú, Lima.

The purchase of several hundred reprints of the article by John H. Rowe, "Archaeology as a Career," to facilitate the provision of information to the many individuals inquiring on this topic was also authorized.

The Executive Committee approved the submission of 2 proposed constitutional changes to the membership by means of a mail ballot following the annual meeting. The first of these is designed to remedy a situation about which some dissatisfaction was expressed by members through the presentation of a slate of officers by the Nominating Committee which did not allow a very great margin of choice by the membership. It is proposed that the portion of Section 2, Article II of the By-Laws which now reads ". . . the Nominating Committee may nominate no more than three member candidates" (for the specified offices) be modified to read ". . . the Nominating Committee shall nominate no more than three nor less than two member candidates."

The second constitutional change which was approved for submission to the membership was a recommendation that the office of President-Elect be substituted for the office of First Vice-President. The Second Vice-President would then simply become the Vice-President. The amendment is designed to permit a person, elected by the Society to serve one year as President-Elect, to be provided with time during which he would become familiar with the duties and responsibilities of the office of President and consequently be better equipped to serve the Society during his tenure as President of the Society in the following year. This would mean, as in a great many other societies, that only a President-Elect would be selected by the membership each year.

The Executive Committee also authorized the Treasurer to retain a Certified Public Accountant for a fee not to exceed $100 to study the Society's accounts and bring the system into a more acceptable form. Approval of participation in the Washington meeting of the American Anthropological Association was given and the incoming President was authorized to arrange the specific details. It was recommended that the incoming President and the Executive Committee consider specifically the following questions: (1) further consideration of the area of professional-amateur relations; (2) the desirability of publishing a manual of archaeological methods, techniques, and so forth; (3) work out with Emil W. Haury a program of cooperation on problems of radiocarbon dating; and (4) consider the possibility of a thorough constitutional revision.

Respectfully submitted,
DAVID A. BAERREIS, *Secretary*

REPORT OF THE TREASURER

General. The Executive Secretary of the American Anthropological Association now handles all billing responsibility and the mechanics of maintaining the membership roster. Coordination between the Executive Secretary of the American Anthropological Association and the Treasurer of the Society for American Archaeology has been satisfactory.

Executive Committee recommendations concerning more explicit accounting and auditing procedures will be instituted.

Finances. Percentages of receipts for the Operating Fund for this fiscal year are as follows: dues, 69%; subsidy for meeting of the Committee for Highway Salvage Archaeology, 10%; publishing subsidies, 9%; sales of publication, 8%; and charges to authors, 4%.

Percentages of expenditures of the Operating Fund for this fiscal year are as follows: AMERICAN ANTIQUITY, all charges but Editor's Office, 64%; Memoirs, 14%; meeting of the Committee for Highway Salvage Archaeology, 10%; dues collections, 5%; transfer to Publication Fund, 3%; Society Officers' Office expenses, 2%; Annual Meeting expenses, 1%; and miscellaneous, 1%.

Membership. The following totals are reported as of April 15, 1958:

Individual	1053
Life	10
Institutional	321
Total	1384

RECEIPTS AND EXPENDITURES

MAY 1, 1957 THROUGH APRIL 15, 1958

A. OPERATING FUND				
1. *Receipts*				
a. Dues received			$10,930.52	
b. Publications receipts				
1. Sales, AMERICAN ANTIQUITY		$ 924.20		
2. Reprints, authors' charges		676.20		
3. Excess engravings, authors' charges		22.00		
4. Sales, Memoirs		342.31	1,964.71	
c. Gifts for publication purposes				
1. Subsidy, Memoir 13		890.00		
2. Publication fund, anonymous donor		400.00		
3. Publication fund, Mr. and Mrs. Wm. Z. Lidicker		75.00		
4. Publication fund, Orville H. Peets		20.00	1,385.00	
d. Subsidy for meeting of the Committee for Highway Salvage Archaeology from Associated General Contractors of New Mexico			1,500.00	$15,780.23
e. Balance forward, May 1, 1957				2,163.19
TOTAL RECEIPTS				$17,943.42
2. *Expenditures*				
a. Publishing				
1. AMERICAN ANTIQUITY				
a. Printing, 4 issues		$ 7,179.05		
b. Distribution		333.58		
c. Reprints		973.25	$ 8,485.88	
2. Editing				
a. Editor's office		274.70		
b. Editorial assistant, 4 issues		800.00		
c. Associate Editors' offices		25.00	1,099.70	
3. Memoirs				
a. Printing Memoir 13		1,079.27		
b. Editorial assistant, Memoir 13		75.00		
c. SAA share, printing Memoir 14		800.00		
d. Distributing Memoir 14		26.40		
e. Editorial assistant, Memoir 15		100.00	2,080.67	
b. Society's Officers' expenses				
1. President's office		65.00		
2. Secretary's office		37.05		
3. Treasurer's office				
a. Office expenses	$ 9.16			
b. Dues collection charges	673.75	682.91	784.96	
c. Annual Meeting expenses				
1. 1957		75.00		
2. 1958		64.83	139.83	
d. Publication Fund transfer			464.34	
e. Meeting of Committee for Highway Salvage Archaeology			1,500.00	
f. Miscellaneous			19.60	$14,574.98
3. *Recorded Cash Reserve*, April 15, 1958				$ 3,368.44
a. Unaccounted for addition to balance in Checking Account, April 15, 1958				1.00
4. *Cash Reserve*, April 15, 1958, deposited in Checking Account, Peoples First National Bank and Trust Company, Oakland Office, Pittsburgh 13, Pa., according to Statement of Account, April 15, 1958				$ 3,369.44
5. *Outstanding*, April 15, 1958				
a. Accounts receivable			517.90	
b. Accounts payable, outstanding check No. 186			33.48	484.42
6. *Total Assets, Operating Fund*				$ 3,853.86

B. PERMANENT FUND

1. *Balance forward*, May 1, 1957	$ 683.50
2. *Interest*	16.31
3. *Balance forward, Permanent Fund*, April 15, 1958	699.81
Deposited in Savings Account No. 54780, Peoples First National Bank and Trust Company, Statement of Account, April 15, 1958	$ 699.81

C. PUBLICATION FUND

1. *Balance forward*, May 1, 1957	$ 4,831.02
2. *Deposit from Operating Fund*	464.34
3. *Interest*	112.68
Deposited in Savings Account No. 54781, Peoples First National Bank and Trust Company, Statement of Account, April 15, 1958	5,408.04
	$ 5,408.04

BUDGET FOR 1958-1959

A. OPERATING FUND				
1. *Receipts*				
a. Cash reserve, April 15, 1958			$ 3,369.44	
b. Dues, 1958-1959			11,200.00	
c. Reprints, authors' charges			750.00	
d. Excess engravings, authors' charges			350.00	
TOTAL RECEIPTS				$15,669.44
2. *Expenditures*				
a. Publishing				
1. AMERICAN ANTIQUITY				
a. Printing	$ 7,500.00			
b. Distribution	500.00			
c. Reprints	1,000.00	$ 9,000.00		
2. Editing				
a. Editor's office	500.00			
b. Associate Editors' offices	75.00			
c. Editorial Assistant	800.00	1,375.00	10,375.00	
b. Society's Officers' expenses				
1. President's office		100.00		
2. Secretary's office		200.00		
3. Treasurer's office				
a. Office expenses	200.00			
b. Dues collection charges	700.00	900.00	1,200.00	
c. Annual Meeting expenses				
1. Routine		150.00		
2. Expense allowances, President, Secretary, Treasurer, Editor		200.00	350.00	
d. Transfer to Publication Fund from Cash Reserve			1,500.00	
TOTAL EXPENDITURES				13,425.00
3. *Cash Reserve*, May 1, 1958				$ 2,244.44
B. PERMANENT FUND				
1. *Balance forward*, April 15, 1958			699.81	
2. *Interest*			20.00	
3. *Balance forward*, May 1, 1959				$ 719.81
C. PUBLICATION FUND				
1. *Receipts*				
a. Balance forward, April 15, 1958			$ 5,408.04	
b. Sale of back issues, AMERICAN ANTIQUITY			600.00	
c. Sale of Memoirs			200.00	
d. Transfer from Operating Fund Cash Reserve			1,500.00	$ 7,708.04
2. *Expenditures*				
a. Publishing Memoir 15			1,699.37	1,699.37
3. *Balance forward*, May 1, 1959				$ 6,008.67

Respectfully submitted, JAMES L. SWAUGER, *Treasurer*

Report of the Auditing Committee

We hereby certify that we have examined the financial records of the Society for American Archaeology as presented to us by James L. Swauger, Treasurer, and to the best of our knowledge and belief they represent a true record of the Society's financial activities and holdings.

Signed:
Don W. Dragoo, *Chairman*
P. Schuyler Miller

Report of the Editor

Volume 23 of American Antiquity, published during 1957-58, consisted of 468 pages and contained 2 editorials, 21 major articles, 5 obituaries, 31 shorter articles in the Facts and Comments section, 65 reviews, and, in addition, Notes and News, Some Recent Publications, a Checklist of Regional Journals, the Membership List, the report of the Annual Meeting, and various notices. No major changes from the preceding volumes occurred, but individual articles averaged a little longer and the space for Facts and Comments was slightly reduced. Authors are now allowed more illustrations without extra charge, but this has not resulted in any noticeable increase in the number of illustrations submitted with manuscripts; instead, it has relieved individual authors of this indirect subsidy of the Society, which in the past has amounted to several hundred dollars a year.

Memoirs 14 and 15 were published as part of Volume 23; they totalled 508 pages, considerably more than the 3 memoirs published with Volume 22. Memoir 14 was published jointly with the University of Utah, which bore the major part of the cost. The cost of Memoir 15 was contributed largely by the Wenner-Gren Foundation, with additional aid from the University of Kentucky. For the generosity which made these 2 memoirs possible, the Editor is deeply grateful. Several smaller gifts from individuals have also been received, and assigned to our Publication Fund for use on future memoirs. Unfortunately, important manuscripts have continued to be lost to us as memoirs because of our inability to secure subventions for their publication. Our Society's funds still remain insufficient to publish memoirs in reasonable number without outside help. Nevertheless, our situation has greatly improved in the past 2 years, and with the active support of all members both in seeking out important manuscripts and in securing funds for publication of those accepted by the Editor the future should promise well.

Each year the number of manuscripts submitted for American Antiquity increases, so that the Editor has to exercise greater and greater selectivity, but he is also offered more scope for assembling a journal of reasonable balance and breadth. It seems desirable to devote attention to all areas of the New World, though with emphasis partly determined by the amount of activity in and general concern for each area. Similarly, in a journal such as ours, a balance should be sought between important data presented descriptively, on the one hand, and discussions that are largely analytic, comparative, synthetic, or methodological, on the other hand. The interests of authors largely determine what the Editor may actually publish, and manuscripts submitted can be considered a rough index of the interests of New World archaeologists. Nevertheless, an Editor should regard his role as partly creative, soliciting manuscripts on topics that need attention, and stressing neglected topics through his selection from those manuscripts submitted. He is not only responsible to the wishes of the Society's membership, whose money he spends, but also to archaeology in general, and must look ahead at developing trends as well as responding to past trends.

Because regional journals are proving able to publish a steadily growing amount of material and reach increasingly wide audiences, it has seemed proper for American Antiquity to devote somewhat more attention than in the past to the broader picture, both selecting and seeking articles that survey or review major areas, analyze problems of wide importance, or present new and stimulating hypotheses or syntheses. In this, however, we are in direct competition with other journals, as the out-going Editor stressed in his report of 1954. Therefore, there is a continuing need for each of us to make American Antiquity our first choice for presenting new and important ideas. Only if what we publish is a "must" for a constantly growing number of readers can we achieve the membership that will provide adequate financial support for our activities. And at the same time, it would seem desirable for our journal to remain open for minority opinions, for descriptions of new and interesting finds, and for comments on topics of current interest.

It is impossible to consider the completion of 4 years as your Editor without satisfaction — satisfaction that the 4-year term has ended. In spite of the considerable pleasure and stimulation that editing provides, it is a task that none of us should be asked to perform for very long, until the time comes that the Society is able to arrange for its Editor to carry on his teaching or other duties on a reduced basis. The time is probably far distant when we can budget even a small amount for part-time salaries for any of our officers, but we should have in mind this future need, at least for Secretary and Editor.

Another satisfaction that the ending of your Editor's term brings is the realization that the journal will be in such good hands for the next 4 years. As review editor, Raymond H. Thompson brought a high degree of enthusiasm and judgment to the task; the future of American Antiquity under his editorship can be contemplated with pleasureful anticipation.

The greatest of the satisfactions that the past 4 years have brought comes from the constant and indispensible cooperation that the Editor has had from everyone concerned with the journal. The individuals responsible for Notes and News, and particulaly C. W. Meighan, have worked long and hard to make that department genuinely useful as a source of news. Authors have constantly shown wonderful patience with editorial whims and with publishing delays. The University of Utah Press has endeavored to produce a journal that would combine

attractiveness with economy, and would set high standards in accuracy; in this they have been extraordinarily successful. Finally, I have been constantly aided by my wife, who has brought unflagging energy and scrupulous care to both copy reading and proof reading, and has also served as professional consultant on an endless series of larger problems. Without the continuing interest and assistance of all these people, your Editor's efforts would have accomplished little and been far less enjoyable.

Respectfully submitted, RICHARD B. WOODBURY, *Editor*

REPORT OF THE ASSOCIATE EDITOR FOR REVIEWS

AMERICAN ANTIQUITY has been published in its present size since Volume 11 (1945-46). During this period 486 reviews have appeared in the 13 volumes (11-23) of the journal, an average of about 9 reviews an issue. The last 3 volumes (21-23) have carried 201 reviews (more than 41% of the 13-year total), an average of about 17 an issue. Volume 21 had the largest number of reviews (80, or 16% of the 13-year total); Volume 14 the smallest number (19, or less than 4% of the total). The largest number of reviews in a single issue was 28, in Volume 21, Number 3; the smallest number was 1, in Volume 14, Number 4 (excluding Volume 17, Number 4 which had no reviews).

Since these reviews were published during the postwar period of growth in American archaeology, they provide a partial index, at least, of the monographic production during this period. The 486 reviews have been classified according to subject and area in an effort to highlight some of the trends in this growth. The assignment of a particular review to any category, even a very broad one, can only be arbitrary. Accordingly, no attempt has been made to achieve a very sensitive classification. The percentage figures have been rounded off to the nearest whole number.

Analysis by subject. The Site Report and Topical Studies categories have been most frequent throughout the 13 volumes. There has been a consistent general increase, especially in recent volumes, in most categories. This is most noticeable in General and Theoretical, Method, and Syntheses.

Site Reports	37%
Topical Studies	22%
Regional Studies	12%
Syntheses	9%
Related Fields	6%
Ethnology	5%
General and Theoretical	4%
Method	3%
Physical Anthropology	1%

Analysis by area. Over the past 13 years Middle America (including Central America) has produced many more publications which the editors have considered worthy of review in AMERICAN ANTIQUITY than any other area. The Southwest is a close second. In a crude way these figures reflect not only the large amount of field work in these 2 areas, but also the consistently high level of publication in monograph form. Some of the areas which are represented by fewer reviews in this journal have produced a good many shorter papers and journal articles of a type not usually reviewed. Nevertheless, the data in this areal summary suggest that in some areas of the New World the publication of results in monograph and summary form is seriously lagging behind field work.

Middle America	21%
Southwest	18%
Highland South America	8%
Southeast	7%
Plains	7%
Pacific Coast-Great Basin	6%
Northeast	5%
Northern Mississippi Valley	3%
Lowland South America	2%
Asia and Pacific	2%
Arctic	1%
Caribbean	1%
Not assignable to area	18%

Respectfully submitted, RAYMOND H. THOMPSON,
Associate Editor for Reviews

RESULTS OF MAIL BALLOT

The membership of the Society for American Archaeology recently approved by mail ballot the changes in the Constitution and By-Laws recommended by the Executive Committee (see p. 217 of this issue). Article V, Section 1 of the Constitution (AMERICAN ANTIQUITY, Vol. 19, No. 2, p. 192) has been changed by a vote of 234 to 16 to read: "The Officers of the Society shall consist of a President, a President-Elect, a Vice-President, a Secretary, a Treasurer, and an Editor." Article II, Section 2 of the By-Laws (AMERICAN ANTIQUITY, Vol. 19, No. 2, p. 193) has been changed by a vote of 239 to 8 to read: "For the offices of Secretary, Treasurer, and Editor the Nominating Committee shall nominate a member candidate. For the other offices the Nominating Committee shall nominate at least two and no more than three member candidates."

OFFICIAL NOTICE

Article II, Section 2 of the By-Laws requires the publication of the following information:

1. Names and addresses of the members of the 1958-59 Nominating Committee: Robert Wauchope (Chairman), Middle American Research Institute, Tulane University, New Orleans, Louisiana; Glenn Black, Angel Mounds, Newburgh, Indiana; Gordon Ekholm, American Museum of Natural History, New York 24, New York.

2. List of offices for which nominations will be made: President (one-year term), President-Elect (one-year term; will serve as President in 1959-60), Vice-President (one-year term), two members of the Executive Committee (two-year terms).

3. Reminder that members may suggest the names of candidates for these offices to the Nominating Committee before December 1.

NOTES AND NEWS

EDITED BY CLEMENT W. MEIGHAN

GENERAL

The editors have decided to discontinue separate Notes and News coverage for *Early Man*. When this reporting was initiated, the question of early man was a key problem in American archaeology. Early sites were few in number and the dating of them was extremely difficult. Consequently, the subject was of special interest and rated a special assistant editorship. It is the only topical coverage since all the other contributions are compiled on an areal basis. Although many early man problems remain to be solved, the increasing volume of archaeological work has made it more practical to include early man reports under the regional headings. Henceforth all material relating to early man should be sent directly to the appropriate regional assistant editor. The Society owes a special vote of thanks to its retiring *Early Man* editor, Alex D. Krieger, who has carried this responsibility for the past 8 years. During this time he reported, analyzed, and evaluated many important discoveries in these pages.

The National Park Service has recently begun a national survey of historic sites and buildings. The survey is intended to identify those sites in the United States which have some national significance. This includes archaeological sites which have produced information of major scientific importance through revealing known cultures or through contributing important evidence on periods of occupation over large areas of the U.S. A list of such sites will be further evaluated as to their scientific importance, present use, condition, suitability for preservation and interpretation, accessibility, and availability.

The Boston Museum of Fine Arts and the Peabody Museum, Harvard University are collaborating in the presentation of the first major show of primitive art in the Boston area. It will open October 15 and run until November 23. About 100 pieces will be shown in 5 major galleries of the Boston Museum of Fine Arts under the title *Masterpieces of Primitive Art*. At the conclusion of the show, a considerable number of the pieces will be moved to a new permanent Hall of Primitive Art in the Boston Museum of Fine Arts in which exhibits will be changed twice a year. Each show will illustrate a specific theme, the first 8 of which have already been planned by Eliot Elisofon, Research Fellow for Primitive Art in Peabody Museum. This joint project has been worked out between Directors J. O. Brew of the Peabody Museum and Perry Rathbone of the Boston Museum of Fine Arts. In selecting the material they will be assisted by Douglas L. Oliver, Elisofon, and Robert G. Gardner. Hans Swarzensky, Curator of Sculpture in the Boston Museum of Fine Arts, will make the installations.

PACIFIC COAST AND GREAT BASIN

UTAH. The archaeological activities of the Department of Anthropology at the University of Utah during the summer of 1958 were concentrated on its salvage program in the Upper Colorado River Basin. Five survey parties were in the Glen Canyon area. One group excavated sites close to the river and upstream from the dam. A joint University of Utah-University of Colorado party excavated a site in the town of Boulder, outside of the area to be flooded but valuable to an understanding of the material in the Glen Canyon area. Two new full-time employees have been added to the staff of the University of Utah's Upper Colorado River Basin Project, Thomas W. Mathews as a field archaeologist and Dee Ann Suhm to supervise the expanded laboratory activities in Salt Lake City.

MONTANA. Work begun by Carling Malouf 2 years ago at historic Fort Owen near Stevensville has been continued with the cooperation of the Montana State Park Department. Once the old building, walls, fences, and other structures inside the fort area have been located, the state and local historical societies will take over the task of reconstruction. Excavations this year successfully outlined the outer palisade, the western barracks, the root cellar, and a wall section of an unidentified structure.

An archaeological survey crew spent 3 days locating and testing sites along the Kootenai River between Libby and Troy in western Montana. Excavations were made in a series of rock piles in an extensive ancient rock slide area along the Bull River about 20 miles south of Troy. The 2 roughly parallel lines of rock piles contained only stones and small fragments of charred wood. The Kootenai Indians are known to have made similar piles of rocks to mark certain events or special places.

IDAHO. The Idaho State College Museum conducted surveys of the Snake and Salmon river system under contract with the National Park Service. Alan Bryan, Harvard University, and Donald Peterson, Idaho State College, examined the upper reaches of the Salmon River and the Lemhi and Pahsimeroi rivers. Donald Tuohy, formerly with the Pacific Northwest Pipeline Corporation, and Chris Hulse, Reed College, surveyed reservoirs on the Snake River, the Wood River, and various branches of the Payette River. Earl Swanson, Curator of the Museum, and John Rice, University of Washington, surveyed the main valley and the Middle Fork of the Salmon River by raft, and 3 reservoirs in the upper reaches of the Snake River.

OREGON. This summer the University of Oregon began a 5 year program of archaeological salvage in the reservoir area of the proposed John Day Dam, covering the major sites along the Columbia River east of the John Day River to McNary Dam. Work on the upper end of the reservoir included investigation of shell middens, camp sites, and burial sites on both the Oregon and Washington side of the Columbia River and on Blalock Island. Another University of Oregon field party, supported by a grant from the National Science Foundation, conducted archaeological investigations on Netarts Sand

Spit in Tillamook County. Excavation of one of the more than a dozen large semisubterranean houses in the village suggests that the site is attributable to an early Salish population on the Oregon coast. This was the third and final season in the Tillamook area, the first to be examined under the Oregon Coast Prehistory Program. In August, 3 small rock shelters on the Klamath River and a site on the southern Oregon coast were tested briefly. The area to be flooded by the proposed Emigrant Creek reservoir was surveyed.

WASHINGTON. Under the direction of Richard D. Daugherty, the 16 students enrolled in the annual State College of Washington summer field school, carried out excavations in the Ice Harbor Reservoir on the lower Snake River under a contract with the National Park Service. Another State College of Washington crew, led by Douglas Osborne, spent 10 weeks excavating caves and rock shelters in the Sun Lakes region of central Washington. This work was supported by funds provided by the Division of Mines and Geology, Washington State Department of Conservation. T. Stell Newman and 5 students conducted salvage excavations in a shell midden at Toleak Point on the coastal strip of Olympic National Park. The work was supported by funds from the National Park Service and a research grant from the National Parks Association to Newman, who is a graduate student at the State College of Washington.

Robert Greengo, University of Washington, continued his work in the Priest Rapids Reservoir area on the Columbia River with funds provided by the Grant County Public Utilities District.

CALIFORNIA. An office of the University of California Archaeological Survey was established in July on the Los Angeles campus. This office parallels the existing UCAS on the Berkeley campus and will allow for increased activity in the southern part of the state. The new office will be directed by C. W. Meighan and staffed by Marshall McKusick (formerly at Yale) and Claude Warren (formerly at the University of Washington). The Berkeley branch of the UCAS made a reconnaissance of Stumpy Meadows, American River, in June and carried out salvage excavations at Prosser Creek and the East Fork of the Carson River in California and Nevada under contract with the National Park Service.

The Department of Anthropology at the University of Southern California conducted archaeological investigations for the National Park Service in 2 watershed projects: Arroyo Grande in San Luis Obispo County and Buena Vista Creek in San Diego County. A second University of Southern California field party carried out a survey in the Mammoth Pool reservoir in the Sierra Nevada mountains near Northfork where the Southern California Edison Company is building a dam.

Adan Treganza, San Francisco State College, reports that during May and June excavations were carried out at the historic Vallejo (Adobe) Ranch at Petaluma. During June and July, Treganza directed the examination of a 16th century Indian shell mound in Marin County in search for further evidence of Sir Francis Drake's California landing in 1579. Both excavations were cooperative projects between San Francisco State College and the California Division of Beaches and Parks. Treganza also continued his work in the Trinity Reservoir this past summer. Under a cooperative agreement between San Francisco State College, the University of California at Berkeley, and the National Park Service, he directed the excavation of a winter sweat house, a dance house, and a village site.

Assembled by R. D. DAUGHERTY.

PLAINS

TEXAS. The National Park Service is closing its River Basin Surveys office at the University of Texas in Austin, a move which has been planned for some time. Henceforth all salvage work in Texas will be arranged through contracts, mainly with the University of Texas. More and more reservoirs are being planned for construction in Texas and the archaeological salvage problem in the coming decade promises to be a difficult one. A major salvage project is being set up by the University of Texas to cope with this problem. Edward B. Jelks, who until now has been running the Park Service field office in Austin, is taking leave from the Park Service to administer the project.

Assembled by E. MOTT DAVIS.

NORTHEAST

The River Basin Surveys and the National Park Service have sharply accelerated archaeological investigations in the northeastern quarter of the country, which corresponds to the recently established National Park Service Region Five. Surveys of 4 reservoir areas in Massachusetts have been completed under contract with Douglas F. Jordan, a graduate student at Harvard University, and 4 additional reservoirs are being surveyed in Connecticut, Vermont, and New Hampshire in order to determine their archaeological potential. The Allegheny Reservoir, in New York and Pennsylvania, is being surveyed by cooperative agreement with the New York State Museum and the Carnegie Museum. Plans for surveys in Corps of Engineers reservoir areas in New Jersey, New England, and Michigan await authorization and funding of the projects. Jacob W. Gruber is conducting archaeological surveys in Bear Creek, Dyberry, Prompton, and Stillwater reservoir projects in eastern Pennsylvania.

Within the National Park Service, Galen B. Ritchie will seek to identify the Great Redoubt of the British at Saratoga National Historical Park, and the grave of Brigadier General Simon Fraser which is known to lie within the Great Redoubt. John L. Cotter has conducted an archaeological investigation at Saratoga National Historical Park, Gettysburg National Historical Park, and has assisted in plans for archaeological interpretation at Acadia National Park, and St. Croix National Monument (to be established) in Maine. G. Hubert Smith has carried out archaeological work at Fort McHenry National Historical Site in preparation for the fulfillment of Mission 66 objectives there. These investigations have re-

sulted in the location of the River Battery, possibly Fort Whetstone, an earlier 18th century fortification protecting Baltimore Harbor, the tavern connected wtih Fort McHenry, and much artifact material related to the War of 1812 and the engagement that inspired "The Star Spangled Banner."

MASSACHUSETTS. The Cohannet Chapter of the Massachusetts Archaeological Society continued work at the Wapanucket site, a small Archaic village at Assawompsett Lake in Middleboro. This season's work included the location of 7 lodge floors, an attempt to define the extent of the village area, and a search for additional secondary cremation burials. During the 1957 season a number of tools from a paleo-Indian assemblage, including fluted points, flake knives, and scrapers, were found on the lake shore adjacent to the Archaic site. The extreme high water of last spring caused considerable wave cutting and new evidence of this period was sought as the water level receded during the summer.

Arthur C. Lord, Jr., a graduate student at Clark University, has undertaken a study of the Postglacial history of the Assawompsett area which will be useful in connection with the study of ancient man in Plymouth County.

NEW YORK. The Niagara Frontier Archaeological Project began field work in the Buffalo area on June 1 with Marian E. White as archaeologist. This project is sponsored by the Buffalo Museum of Science and the Department of Anthropology and Linguistics at the University of Buffalo, and is aided by a grant from the Zonta Club of Buffalo. During July and August excavations were carried on jointly with the New York State Museum and Science Service. Members of the field party included James V. Chism, William B. Roosa, and Marian E. White. They investigated the settlement pattern of the Oakfield site in Genesee County, a Transitional Iroquois site encircled by an earth embankment which was examined for indications of a palisade. An area inside the embankment was tested for remains of houses. Charcoal from the Oakfield site has been dated by the University of Michigan Radiocarbon Laboratory (Sample M-651) at 420±150 years B.P. Additional work was also done on a Contact Period Iroquois site south of Buffalo.

The Rochester Museum of Arts and Sciences continued the investigation of the Morrow site near Honeoye where Alfred K. Guthe supervised the examination of the ditch surrounding an Owasco village.

George A. Agogino, Syracuse University, reports the completion of 2 years of excavation at Onondaga Castle (1679-1696) near Jamesville. The field supervisors were Ronald Kingsley in 1956-57 and Ethel Fine in 1957-58.

Joining the ranks of archaeological societies is a new organization, The New York City Archeological Group, 220 Cabrini Boulevard, New York 33, N.Y. Officers are: Director, Julius Lopez; Associate Directors, Stanley Wisniewski, Julius Diosi, Harold Trowbridge; Executive Secretary, Michael Cohn. The objectives of the Group are explorations and a series of excavations in the New York coastal area, with particular emphasis on sites in the Greater New York City region. The program envisioned also includes photographing and studying for publication the many collections in private and institutional hands. Membership will be restricted to seriously interested persons and to students of anthropology at colleges and universities in this area. Several sites have already been excavated by the Group and others are in progress. Persons interested in participating in the excavations, or in related research projects, are invited to contact the Executive Secretary.

PENNSYLVANIA. The Susquehannock Cemetery at the Ibaugh site (1600-1625) Washington Boro, Lancaster County was reexamined by the Pennsylvania State Museum, under W. Fred Kinsey's direction. Kinsey also supervised the exploration of a second longhouse floor plan on the Leibhart site, a Susquehannock occupation (1650-1675) at Long Level in York County. A motion picture film record was kept of the work as it progressed. This will form a part of a popular short film being prepared by the Pennsylvania State Museum which will be keyed to museum exhibit and educational activities.

Carnegie Museum, in cooperation with the West Virginia Archeological Society and the Hanna Coal Company, began the excavation of the Gatts Mound near Moundsville, West Virginia during the first week of June 1958 under the direction of Don W. Dragoo. Several interesting items of Adena culture were found in the excavations. The completion of this project should add much to our knowledge of Adena in the Upper Ohio Valley. During the late summer, Dragoo continued Carnegie Museum's survey of northwestern Pennsylvania. James L. Swauger of Carnegie Museum has begun a study of the petroglyphs of the Upper Ohio Valley.

ONTARIO. Kenneth E. Kidd reports the Royal Ontario Museum sponsored and co-sponsored work in widely separated parts of the province. Walter Kenyon spent a month investigating "Point Peninsula type sites" on Cameron's Island and other locations in Lake St. Francis. The area contains several sites of this occupation, but many have been seriously "pot-holed." Kenyon also examined the remains of a mound on Pither's Point, near Fort Frances which had been much eroded by the Rainy River. This work was carried on by the museum, with the assistance of a small grant from the Ontario Archaeological and Historic Sites Board. The excavations in Serpent Mound Provincial Park were supervised by Richard B. Johnston with the cooperation of the Department of Lands and Forests for Ontario, and the Serpent Mounds Foundation of Peterborough. Selwyn Dewdney continued the project of recording pictographs in the Quetico Park area at the head of the lakes. This was begun last year and has the support of the museum, the Quetico Foundation, and the Department of Lands and Forests.

Assembled by A. K. GUTHE.

MIDDLE AMERICA

MEXICO. Substantial progress has been made in recent years on the correlation of Mesoamerican archaeology with that of the American Southwest. The most productive results bearing on this problem have been contributed by the Southern Illinois University expeditions to Durango, where work at the Schroeder site is nearing completion. The field director, J. Charles Kelley, has been making a thorough survey of relevant materials in the museums of Mexico and of the Southwest in preparation of a definitive appraisal of the results. The expedition planned to return to the field last summer for a final check at the site and a more thorough survey of the region. With the Amerind Foundation planning to attack the problem from the Southwest side of the cultural border at Casas Grandes, Chihuahua, specialists in the 2 fields now meet on a common ground of interest.

Meanwhile, the attempt begun by Brainerd in 1954 and 1955 to iron out some of the difficulties that still impede the construction of a detailed ceramic chronology for the Valley of Mexico, particularly those concerned with the interval between the Classic Teotihuacan period and the advent of the Toltec, is being continued by H. B. Nicholson of the University of California at Los Angeles. In August, 1957, Nicholson made stratigraphic test pits at the site of Portesuelo and finished clearing a Classic period structure. He plans to study and publish Brainerd's material and to expand the project to include a survey of other sites in the vicinity and an appraisal of the relevance of historical data to the archaeological finds.

An earlier period in the valley is being explored by several independent projects. Carmen Cook de Leonard and René Millon in their excavations of August, 1957, discovered an important Teotihuacan I area west of the Pyramid of the Moon, and have published a preliminary statement of the finds in the last CIAM Bulletin. Earlier that summer, Robert F. Heizer, together with A. B. Elsasser, René Millon and R. J. Squier, all of the University of California at Berkeley, and Eduardo Contreras of the Instituto Nacional, investigated mounds at Cuicuilco previously reported by Eric Wolf and Angel Palerm. These mounds, termed Cuicuilco B, represent mainly the period of Ticoman III. The work was briefly reported by Heizer last January in *Science*. The work of César Lizardi Ramos and Florencia Muller at Huapalcalco covers a wider range of time. In their excavations they define 3 structures associated with ceramics ranging from Ticoman I through Teotihuacan I, and a fourth of Classic date. The Preclassic structures consist of a very high sloping zone faced with uncut stone, surmounted by a vertical zone between 2 slab moldings. A radiocarbon assay by the University of Michigan places the latest of the Preclassic structures (Teotihuacan I, Ticoman III) at about A.D. 300 ± 200, and a tomb on the floor of the earliest structure at about A.D. 1 ± 200. This season's work consisted largely of restoration and consolidation of the structures, which will for the first time illustrate this period of architecture.

Relations between the valley and coastal Veracruz are also being gradually elucidated. A communication from José García Payón tells us that on the road from Poza Rica to Cazones architectural remains of Classic Teotihuacan type have been uncovered, and that fine examples of Teotihuacan wares were coming out of recent excavations undertaken by the Instituto de Antropología del Estado de Veracruz at El Faisán, near Villa Cardel and at Nopiloa, near Tierra Blanca. Some Olmec pieces have also been reported from the latter site. At El Tajín, García Payón continues with work on Structures B and C of Tajín Chico, and is engaged in repairing the damage to the main pyramid caused by the earthquake in Mexico 2 years ago. The museum which is shortly to be officially opened at Xalapa will receive 4 of the colossal heads excavated by Stirling at Texistepec (San Lorenzo). A splendid Parque Olmeca opened recently at Villahermosa, has already made available for public inspection some of the best monuments of the Olmec style from La Venta, Tabasco.

Ignacio Bernal, now head of the division of Monumentos Prehispánicos of the Instituto Nacional, reported at a recent Mesa Redonda conference on his work in Oaxaca and we are anticipating the general summary that he plans of our present knowledge of this region as well as a survey of its major archaeological problems.

MAYA AREA. Having completed its preliminary work of building and clearing at Tikal, the University of Pennsylvania Museum expedition to Tikal really got under way with digging last season. The staff, headed by Edwin M. Shook, included William R. Coe, Vivian Broman, and Richard Adams as archaeologists. James Hazard (for the misspelling of whose name in our last issue we tender him our apologies) was assisted in his mapping work by Newton Le Vine and Richard Wurman. Jane Adams and Olga Hazard assisted in the laboratory and Burt Noble and George Guillimen were engaged in the repair of monuments.

The most important data came from the excavation of the plaza-wide stairway leading to the north terrace from the main plaza. A test trench across the plaza, reaching bed rock and penetrating the stairway, revealed concentrated deposits of Chicanel pottery in the lower levels, and correlative with them a buried structure under the north terrace, indicating that the essential features of the plaza were probably laid out even before the beginning of the Classic Period. The underlay of Chicanel material was heavy and general in the central area, but Mamom finds were sporadic, suggesting that in the early Preclassic stage of occupation the ceremonial center was in another location.

A second important find was in an exposed cut through the floor of Temple I, penetrating 2 m. into the fill. The upper 75 cm. of the cut was filled with recent debris, but beneath this were burned human bones, incense burners, and vessels of types not previously found at Classic sites and denoting a late Postclassic period, probably corresponding to that of Mayapán in the north.

Major attention was given to the study of substelae caches and to problems related to ancient breakage and reerection of monuments. A monument once standing in the back room of Str. 34 had been smashed to bits, and its fragments were found piled into a heap and incorporated into a masonry altar in which were found a number of caches containing various marine materials, wrapped in bundles with other artifacts and burned. Ceramic evidence seems to indicate that the stela may have been destroyed in the course of disturbances accompanying the transition from Early to Late Classic times.

The season at Tikal terminated July 15 without serious shortage of water, though the project of drilling wells has had to be abandoned in favor of deepening water holes and employing various methods of retarding evaporation. The expedition hopes to carry on with available sources. A hotel of 12 rooms is now ready for the accommodation of visitors.

Linton Satterthwaite, archaeologist-in-chief of the Tikal Project, made a 3 weeks' visit to Tikal. Before that he spent 12 days as guest of the Signal Oil Company, studying the newly discovered Late Classic Maya site of Xutilhá, about 9 km. west of San Luís in southeastern Petén. The site resembles those near Poptún in the character of its masonry, which is of slabs and blocks, with no identifiable remains of lime mortar or plaster and no signs of vaulted roofs. It differs in showing a much more extensive and complicated system of courts, and 12 stelae and 10 altars in front of one of the platforms. Minor excavations revealed a single floor level and uncovered a handsome figurine and sherds indicating a Late Classic but not Early Classic occupation. Certain censer fragments may belong to a Postclassic level. The monuments are in poor condition, but one Initial Series may possibly be decipherable. Large upper portions of 3 of the stelae are unaccountably missing and there is evidence of the resetting of 2 stelae.

In the vicinity of Lake Yaxhá, William R. Bullard explored Classic period settlements that ring its borders, making test excavations in selected mounds. He also visited the island ruin of Topoxté, which appears to be of later date. Here he found a greater concentration of housemounds about the ceremonial center than on the mainland at Yaxhá. After spending nearly 2 months at the lake, Bullard continued the study of settlements at Dos Aguadas, between Fallabón and Tikal, and had plans to visit other Petén ruins before his return.

The work at Palenque has been handicapped recently by lack of funds, but Rands is pursuing his ceramic studies and gave us word recently that the Humble Oil Company has made radiocarbon assays of 2 charcoal samples from the site, which supplement the chronological evidence of the inscriptions.

The work of reconstruction of ruins in Yucatán continues and there is some expectation that it may be shortly stepped up by the recent formation of the Instituto Yucateco de Antropología e Historia, under the direction of Fernando Cámara Barbachano. The Instituto has the support of both the state and the federal governments and is housed in the Governor's Building on the Paseo Montejo in Mérida. Collections from nearly 90 Maya sites, formerly in the Mérida office of the Carnegie Institution of Washington have been removed to this building and are so organized as to be available for study.

Excavations, at the time of writing this report, are still in progress at Dzibilchaltún under the direction of E. Wyllys Andrews. We understand that the National Geographic Society is taking part in the project, and that funds are now available for several years ahead to expand a study of Classic and earlier period sites in this area.

A much later period is being explored by John M. Goggin of the University of Florida, who, following our a survey of Spanish Colonial sites made during the summer of 1956, conducted a test excavation at the Ciudadela, Mérida, in August, 1957. A cut reaching sterile soil 16 feet below the present surface, revealed a 6-foot layer of refuse ranging from modern times to the beginning of the 17th century, below which was a 9-foot zone of loose rubble with a few scattered Mayan and Spanish sherds, resting in turn on a 1-foot layer containing some late Classic Maya material. In the refuse zone, numerous wall foundations were found and just below the surface of the rubble, a Spanish Colonial pipeline cut across the trench. A very large series of Colonial sherds was collected. Despite 19th century disturbance of the refuse layer, the test will contribute substantially to the picture of Spanish Colonial ceramics and archaeology in Yucatán.

Richard MacNeish writes us that on his recent trip to the southeastern Maya area he failed to locate dried vegetable remains in any of the caves he visited. In the Copán area, he saw a number of caves that had been occupied during the Formative period. Drier caves of the Comayagua area of Honduras often contained burials of unknown period. Near Tegucigalpa, there was one which yielded only nonceramic remains. Four caves in the Zacapa Valley of Guatemala contained evidences of late Postclassic occupation. Although results bearing on the main objective of the trip were negative, the survey opens a fruitful field that has yet to be investigated.

In the highlands of Guatemala and on the Pacific coast attention is focused mainly on Preclassic remains. The newly discovered monument from Kaminaljuyú mentioned in our previous report, was excavated by E. M. Shook in the course of a small stratigraphic trench made at the instance of Miss Heath-Jones of Cambridge, Massachusetts, who was interested in establishing more firmly the archaeological association of a similar early monument discovered in 1956, and who expects shortly to publish her investigation of these finds.

From January to March, 1958, Michael D. Coe worked at the site of La Victoria, 3 km. north of the coastal village of Ocós in Guatemala, near the Mexican border. The site consists of 8 very low house mounds that at one time fronted on a lagoon. In spite of the insignificant architectural remains, midden accumulation in some places reached a depth of 6 m. Preliminary sorting of materials resulted in the designation of 2 sequent phases, Ocós and Conchas, followed by a long hiatus and a final phase, Marcos, containing San Juan Plumbate ware. The earlier phases show definite similarities to material from

Chiapa de Corzo. Resemblances to highland Guatemala forms are less striking, but identification of some sherds with the Las Charcas phase, gives promise that the La Victoria material will help to link the sequence of Chiapa de Corzo with that of Kaminaljuyú.

CENTRAL AMERICA. Word seldom comes to us from Central America, but the recent work of Wolfgang Haberland of Hamburg in El Salvador, Costa Rica and Panama, on which several small papers have been published, prompted us to inquire about his further plans. We learn that full reports of his excavations in Costa Rica and Panama have been completed in manuscript and that he planned to return to El Salvador after attending the 33rd International Congress of Americanists at San José. The plans included additional investigation of the footprints earlier discovered on the hacienda "La Carrera," further elucidation of the Preclassic Atiquizaya phase, and reconnaissance, which will add to the archaeological map of El Salvador. In November, Haberland intends to return to Costa Rica and to remain till January, 1959, investigating the Oça peninsula, and possibly the Atlantic coast. Later, he shifts his field to Panama, especially to Chiriquí, to develop further his work on stratigraphy there. Haberland's investigations should help greatly to integrate our scattered knowledge concerning an area that to date has been only spottily covered.

Assembled by TATIANA PROSKOURIAKOFF.

LOWLAND SOUTH AMERICA

ARGENTINA. The first International Round Table of Anthropology was held under the auspices of the Sociedad Argentina de Antropología from November 11-15, 1957 at the Museo Etnográfico in Buenos Aires. Foreign delegates included Eugenio Petit Muñoz, Carlos M. Fein and José Joaquín Figueira from Uruguay; C. Henckel and Luis Sandoval Smart from Chile, and Paulo de Carvalho Neto from Brazil. The inaugural session was opened by the president of the host society, Fernando Márquez Miranda. The first paper, delivered by Ciro René Lafón, dealt with relationships between northwest Argentina and the Andean cultures. On succeeding days, the following topics were covered: Paulo de Carvalho Neto, The Macá of the Paraguayan Chaco; Manuel de Ugarriza Aráoz, Analogies in the Mythological Thought of American Tribes; Osvaldo F. A. Menghín, Observations on Guaraní Archaeology; J. J. Figueira, Ethnographic and Archaeological Relationships between Argentina and Uruguay; Carlos M. Fein, Indigenous Ethnic Groups in Uruguay and Their Relation to the Argentine Mesopotamia and the Delta of the Paraná; Eugenio Petit Muñoz, The Charrua and their Possible Origins; Rodolfo Casamiquela, On a Problem in Araucanian Linguistics; Federico Escalada, Tehuelche Affiliations; C. Henckel, Aspects of the Physical Anthropology of the Mapuche; Carlos Munizaga Aguirre, Preliminary Results of an Expedition to Socaire, including New Ethnobotanical Data; Alberto Medina, The Aborigines of Central Chile and their Affiliations with those of Argentina; Luis Sandoval Smart, Blood Groups of Chilean Indians. Each paper was followed by discussion. A detailed account of the results is being prepared by Paulo de Carvalho Neto for publication in the next issue of the *Boletín Bibliográphico de Antropología Americana*.

BRAZIL. Peter Paul Hilbert of the Instituto de Pesquisas da Amazonia, Museu Goeldi, Belém, spent from March to July 1958 at the Division of Archeology, U.S. National Museum, classifying pottery excavated at Itacoatiara, Manaos, Manacapurú and sites on the Rio Tapajoz. Four separate archaeological cultures were distinguished. A preliminary report on the Manaos-Itacoatiara sequence and its affiliations was completed for presentation at the 33rd International Congress of Americanists in San José, Costa Rica during July 1958.

URUGUAY. The Sociedad "Amigos del Museo Nacional de Historia Natural," founded in the beginning of 1956, has acquired the large archaeological collection of Carlos A. de Freitas for the Museo Nacional. This collection constitutes a major part of the 18,000 archaeological objects recently added to the museum. In June 1957, the Sociedad opened an exhibit of the material in the Freitas collection. The ceramic section was divided into 3 parts: pottery of the mouth of the Rio Negro, pottery of Uruguay, and pottery of Argentina. All 19 of the departments into which Uruguay is divided were represented in the section on stone objects. Bone tools from the mouth of the Río Negro and skeletal material from the Departments of Soriano and Río Negro completed the display.

A short course on anthropology was given at the Instituto de Sociología, Facultad de Derecho y Ciencias Sociales, Universidad de la Republica in the fall of 1956. One of the 5 lectures was on problems and methods of archaeology in Uruguay, given by José Joaquín Figueira. A similar but somewhat expanded course is planned for 1958. A conference and 2 round tables were organized by the Laboratorio de Geografía Física y Biológica, Facultad de Humanidades y Ciencias, in November and December of 1957. The former was on Arenales y palmares del Río Negro y arqueología uruguaya; the latter on Los métodos de la geochronología and Materiales líticos utilizados por los indios del Uruguay.

Assembled by BETTY J. MEGGERS.

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DE LAGUNA, FREDERICA
1953 Some problems in the relationship between Tlingit Archaeology and Ethnology. In "Asia and North America: Transpacific Contacts," assembled by M. W. Smith. *Memoirs of the Society for American Archaeology*, No. 9, pp. 53-7. Salt Lake City.

HEIZER, R. F. AND FRANKLIN FENENGA
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MACGOWAN, KENNETH
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